# Chemical Engineering

DECEMBER 1955

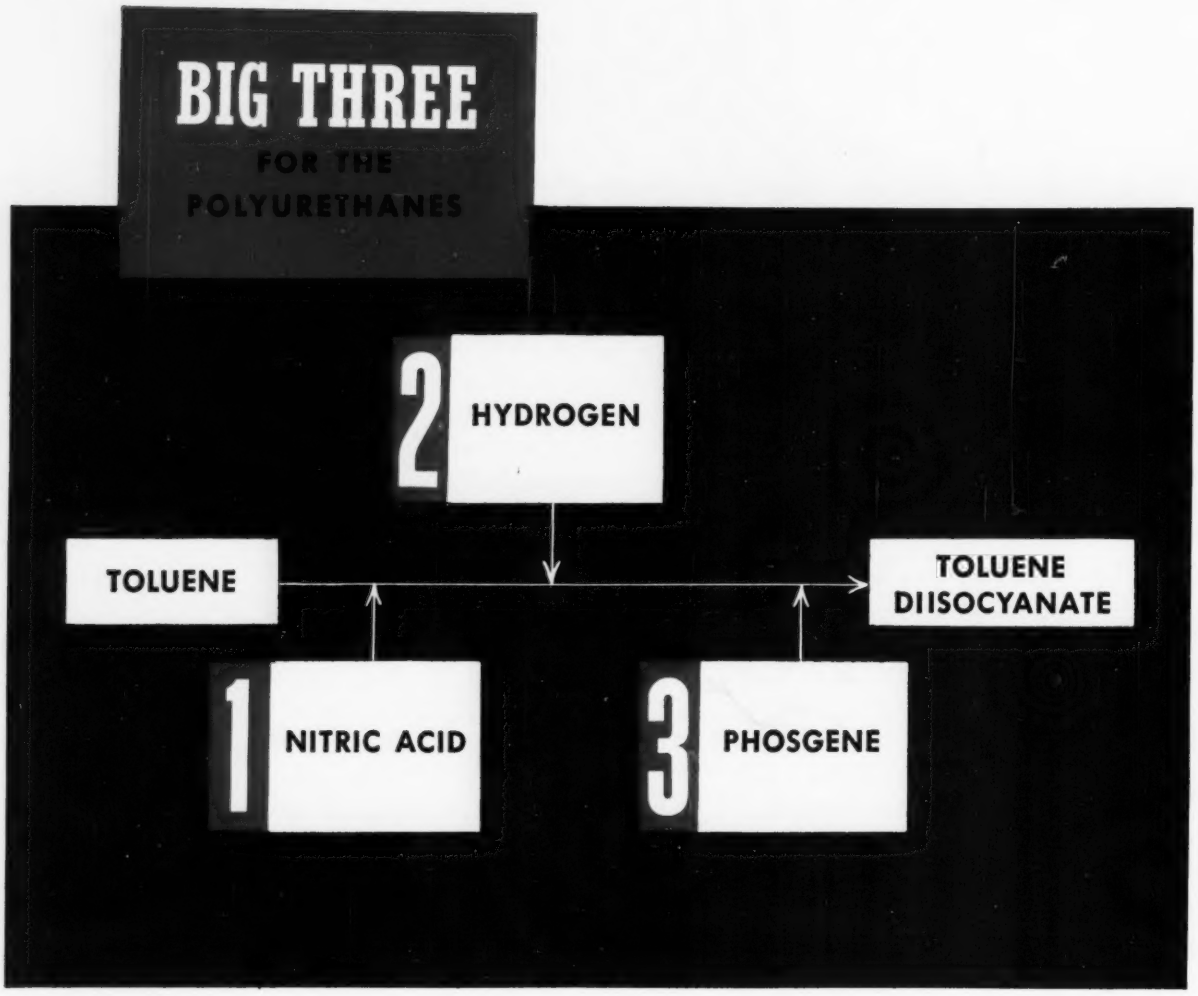
## chemical engineers invade the market place

CHEMICAL ENGINEERING ACHIEVEMENT AWARD GOES TO DOW-CORNING

SILICONES

A McGRAW-HILL PUBLICATION

ONE DOLLAR




# GIRDLER plants supply three major ingredients for isocyanates

TOLUENE DIISOCYANATE, now popular for production of versatile polyurethanes is produced basically as shown above. Other isocyanates may be made in a similar manner. Three of the ingredients—*nitric acid, hydrogen* and *phosgene* are made with Girdler plants.

Here is another example of the contribution Girdler plants are making to important chemical developments. Girdler designs, engineers and constructs process plants for many products, assuming responsibility for sound results. We are particularly experienced in high-temperature, high-pressure processes involving corrosive materials. Call the nearest Girdler office for complete information.

**GIRDLER DESIGNS** processes and plants
**GIRDLER BUILDS** processing plants
**GIRDLER MANUFACTURES** processing apparatus

**GAS PROCESSES DIVISION:**

| | |
|---|---|
| Chemical Processing Plants | Nitric Acid Plants |
| Hydrogen Production Plants | Acetylene Plants |
| Hydrogen Cyanide Plants | Sulphur Plants |
| Synthesis Gas Plants | Ammonia Plants |
| Carbon Dioxide Plants | Ammonium Nitrate Plants |
| Gas Purification Plants | Hydrogen Chloride Plants |
| Plastics Materials Plants | Fertilizer Plants |
| Formaldehyde Plants | Hydrogen Sulfide Plants |

Catalysts and Activated Carbon

the **GIRDLER** Company

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**LOUISVILLE 1, KENTUCKY**
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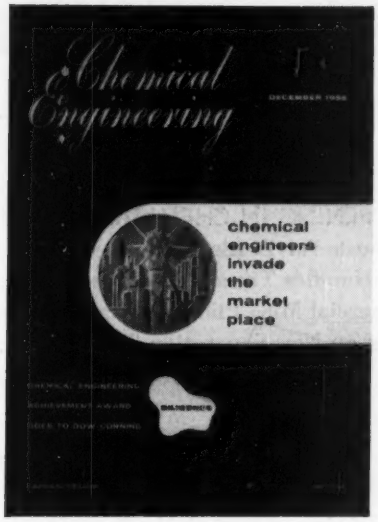
# GUIDED TOUR

JOHN R. CALLAHAM, EDITOR




**. . . Product development as well as process development.**

Dow Corning's chemical engineers played a major role in product and market development of silicones and related products. Their marketing and technical sales techniques forced a significant first.

For the first time Chemical Engineering's coveted award must go to recognize achievement beyond purely technical success. So says the 84-man award committee of senior chemical engineering educators.

Here's Editor Kirkpatrick's behind-the-scenes account of the important participation of chemical engineers. (p. 175)

**Why here's better than there.**

Take a dozen steps toward finding the best site for a new plant. The technique allows maximum confidence in optimum solution obtained in minimum time. (p. 191)

**What's new in pneumatics.**

Trend toward automation will expand the use of pneumatic relays for process control,

**Please turn page**

**Technology: A Look Ahead**

Next month we'll bring you something new in reports: An interpretive roundup of major technological developments and trends of the year.

This will not be a cut-and-dried review of the literature. Nor will it attempt to record all developments regardless of their relative merits.

Instead, it will be a 16-page critical rundown of major trends and what they'll mean in the years ahead. It will point up and put into perspective major advances in theory, equipment, processes, products, unit operations, techniques, engineering economics.

Subjects our engineer-editors will review this year run the gamut from automation and nuclear energy to statistical techniques and chemical engineering education, from evaporation and extreme reaction conditions to polyethylene and synthetic fibers.

We're starting this annual series on technology advances because our reader research shows us you want it. Take a good, hard look at our January report — then let us know how we're doing! — JRC

particularly where safety and extra reliability are required. A system of notation will simplify circuit design. (p. 185)

**Your reactor system.**

Nine new charts are going to speed up your job of designing reactor systems. Tedious calculations are cut down or eliminated altogether. Pick the best reactor system by mere visual inspection. (p. 198)

**Pipes within pipes . . . how to specify.**

You've demanded and gotten more and more complicated heat exchangers. Know-how that manufacturers can offer will ease your job of specifying. (p. 203)

**The art of the educated guess.**

Here's how—without accurate data—you'll make the most accurate estimate of Schmidt number for mass transfer problems under conditions of composition, temperature and pressure. (p. 207)

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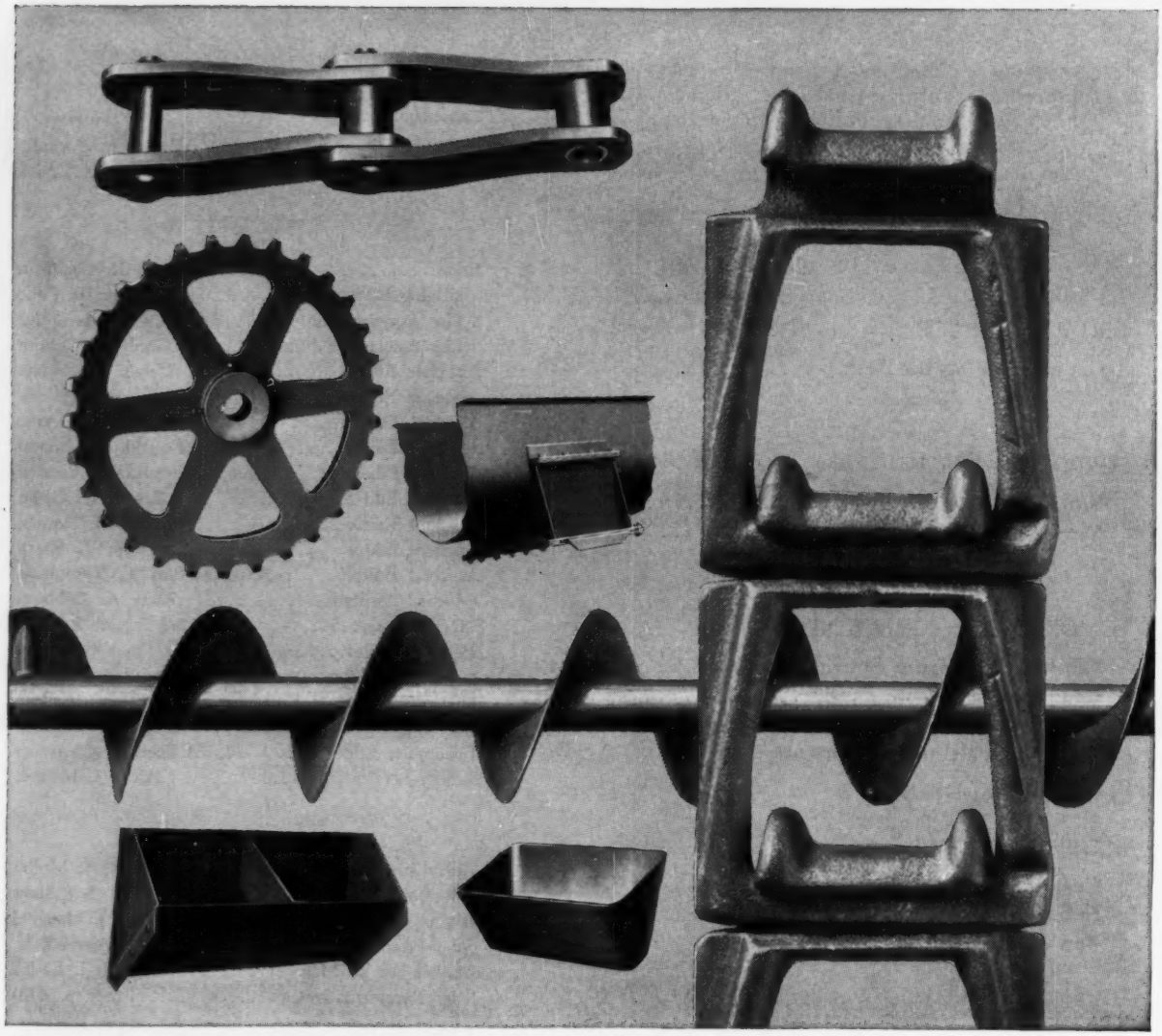

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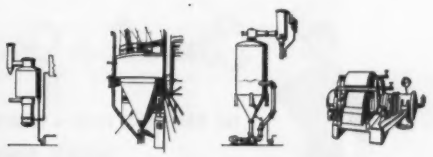
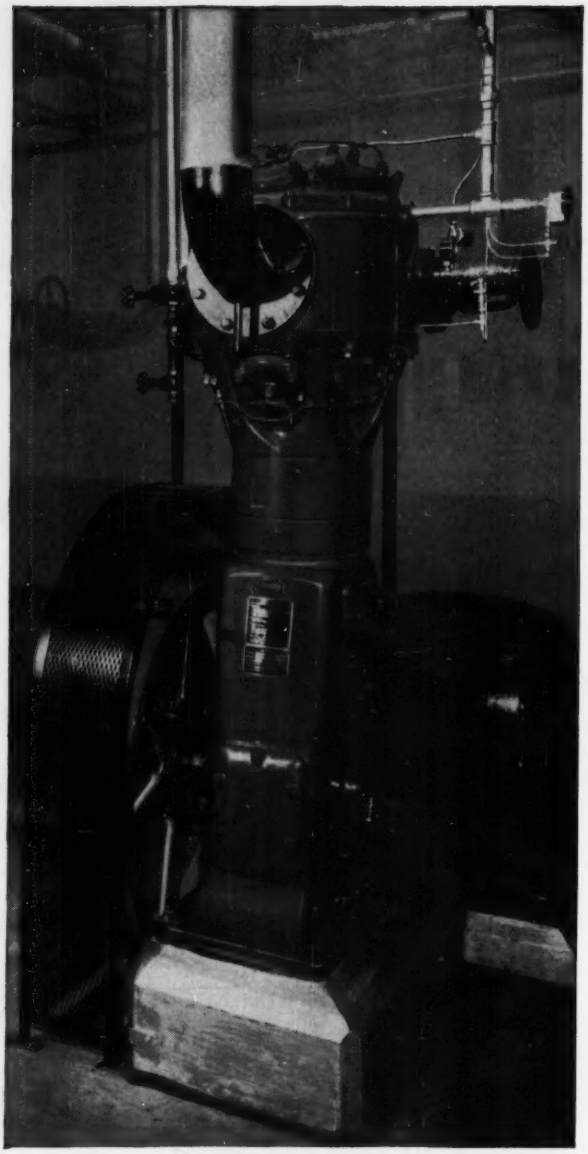


EVAPORATORS • SPRAY DRYERS • CRYSTALLIZERS • FILTERS

# OIL-FREE AIR?

## You'll be three steps ahead with the JOY WGO-9 COMPRESSOR



**1** **VERTICAL DESIGN**—Saves floor space, allows simple installation. Prevents uneven wear in carbon rings. Eliminates necessity for periodic turning of piston to equalize ring wear.

**2** **LONG-ROD CONSTRUCTION**—Spacer between crankcase and cylinder absolutely prevents passage of oil into cylinder. No part of the piston rod that enters the crankcase can enter the cylinder. No possibility of air contamination.

**3** **SECTIONALIZED CARBON RINGS**—Expanders maintain ring-contact with cylinder wall despite wear. Rings last longer.

The Joy WGO-9 "long-rod" compressor is the result of more than twenty years' experience in the design and manufacture of non-lubricated compressors. In addition to the carbon graphite piston rings that need no lubrication, the Joy WGO-9 features special lightweight pistons; large, direct air passages; and liberal waterjacketing to reduce heat and minimize ring wear.

The patented Dual-Cushion Valves are made of corrosion-resistant materials. In addition, all metallic wearing surfaces are either chrome-plated, surface-hardened, or made of stainless steel.

Free Bulletin A-44 gives details on the Joy WGO-9 Oil-Free Compressor. Write for your copy TODAY to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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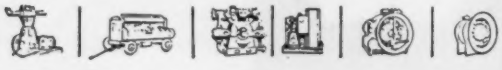

**JOY** W&D 1-5589

**SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885**

# MARLEY IS TESTING COOLING TOWERS

## AND HERE IS THE RECORD

| TEST NO. | TYPE OF SERVICE AND LOCATION | SPECIFIED CONDITIONS | | | | TEST RESULT | |
|---|---|---|---|---|---|---|---|
| | | Gallons Per Minute | Hot Water Temp. | Cold Water Temp. | Wet Bulb Temp. | [1]Degrees Cold Water Temp. | [1]Percent Capacity |
| 1 | Air Conditioning—West Coast | 400 | 90° | 80° | 70° | +0.80° | +9.4% |
| 2 | Air Conditioning—Gulf Coast | 6,500 | 101.3° | 88.5° | 80° | —0.40° | —4.3% |
| 3 | Chemical Plant—East Coast | 18,500 | 104° | 89° | 76° | +0.50° | +3.8% |
| 4 | Chemical Plant—East Coast (1 of 4 duplicate units) | 27,500 | 103° | 88° | 76° | —0.40° | —3.2% |
| 5 | Power Plant—Southwest | 57,500 | 109.6° | 92.6° | 78° | —0.04° | —0.4% |
| 6 | Petroleum Refinery—Gulf Coast | 3,400 | 115° | 80° | 70° | +0.90° | +8.5% |
| 7 | Power Plant—South Central | 83,000 | 108.1° | 90° | 76° | —0.04° | —0.4% |
| 8 | Power Plant—Mountain States | 45,000 | 105° | 83.7° | 63° | +0.20° | +0.8% |
| 9 | Petroleum Refinery—Gulf Coast | 15,000 | 111° | 90° | 82.5° | +0.70° | +7.7% |
| 10 | Petroleum Refinery—Gulf Coast | 36,570 | 120° | 90° | 82° | —0.60° | —4.4% |
| 11 | Power Plant—Southwest | 70,450 | 102.6° | 86° | 70° | —0.86° | —4.4% |
| 12 | Power Plant—Southwest | 70,450 | 102.6° | 86° | 70° | —0.51° | —2.7% |
| 13[2] | Power Plant—East Central | 13,000 | 101° | 85° | 75° | —3.70° | —24.3% |
| 14 | Power Plant—Mid-Central | 44,000 | 100° | 86° | 74° | +0.45° | +4.0% |
| 15 | Power Plant—South Central | 83,000 | 108.1° | 90° | 76° | —0.80° | —4.3% |
| 16 | Chemical Plant—South | 40,000 | 103.3° | 85° | 78° | —0.30 | —3.0% |
| 17 | Power Plant—North Central | 37,000 | 100.5° | 83° | 72° | +1.20° | +9.6% |
| 18 | Petroleum Refinery—East Coast | 15,570 | 115° | 85° | 76° | +1.10° | +9.0% |
| 19 | Power Plant—Mountain States | 65,000 | 101.7° | 82° | 63° | +0.78° | +4.1% |
| 20 | Chemical Plant—Gulf Coast | 40,750 | 123° | 90° | 80° | —0.16° | —1.2% |
| 21 | Chemical Plant—Gulf Coast | 11,000 | 116° | 90° | 80° | +1.80° | +13.2% |
| 22[3] | Retest of Tower Reported in No. 14 | 44,000 | 100° | 86° | 74° | +0.45° | +4.0% |
| 23[4] | Retest of Tower Reported in No. 11 | 70,450 | 102.6° | 86° | 70° | +0.20° | +1.1% |
| 24[4] | Retest of Tower Reported in No. 12 | 70,450 | 102.6° | 86° | 70° | +0.33° | +1.8% |
| 25 | Petroleum Refinery—East Central | 6,000 | 125° | 90° | 75° | —0.46° | —2.6% |
| 26[5] | Petroleum Refinery—Gulf Coast | 10,000 | 120° | 85° | 79° | +0.30° | +3.2% |
| 27 | Power Plant—Southwest | 72,000 | 112° | 92° | 78° | +1.05° | +6.6% |
| 28 | AEC—East Central (1 of 2 duplicate units) | 62,798 | 132.3° | 90° | 80° | +0.31° | +3.5% |

NOTES: 1) Plus indicates capacity exceeding specified performance; minus denotes deficiency. 2) Tested to determine loss of performance due to extensive settling of basin and resultant misalignment of structure. 3) Retested at higher wet bulb. 4) Retested at contract (higher) horsepower. 5) Tested in accordance with Cooling Tower Institute test procedure (ATP-105 adopted May 1, 1955) and observed by CTI representative.

**HERE IS THE RECORD** — a consecutive list of ALL acceptance tests conducted by Marley during the 1954-1955 test seasons. All are full-scale tests conducted in strict accordance with specified methods.

Towers tested were of many sizes and capacities, operating under widely varying conditions. Geographically, these tests spanned the entire country and included towers sold since 1950, located at elevations up to 5,000 feet.

**HERE IS THE RECORD** that offers **more positive assurance of performance satisfaction than any guarantee ever written.** It shows why Marley has the complete confidence to insist that you TEST YOUR TOWER.

MARLEY

**The Marley Company**

Founder-Member Cooling Tower Institute

Kansas City, Missouri

# MADE BY SPECIALISTS in *Stainless Steels, Monel, Nickel, Aluminum*

## The FLOWLINE Elbow

TRADE MARK

FLOWLINE Fittings are made by specialists having more experience with corrosion-resistant piping than any other fitting manufacturer. Our exclusive process of cold forming and annealing produces fittings in the best condition for corrosion service. The use of FLOWLINE Fittings makes available to users of corrosion-resistant piping the efficiency and economy of simplified welded construction.

The FLOWLINE Ell is typical. Its long radius and smooth interior walls assure full effective sweep, reduce pressure loss, minimize flow resistance, corrosion, erosion, and product accumulation. The ell is round and ends are accurately machine tool cut and finished; it is easy to fit to pipe.

FLOWLINE Welding Fittings—tees, ells, reducers, stub ends, and caps—are made and normally stocked in Schedules 5S, 10S, 40S, and 80S—sizes ½" through 12"—in stainless types 304, 304L, 316, 347; Monel, Nickel, Aluminum. All fittings are annealed, cleaned bright—stainless fittings are passivated—and marked with type of metal, heat number, size, schedule, and wall thickness.

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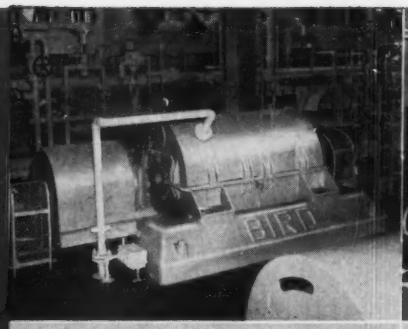
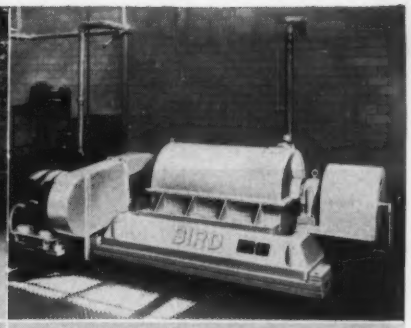
NEW CASTLE, PENNSYLVANIA
*World's Largest Manufacturer of Stainless Welding Fittings*

W-11

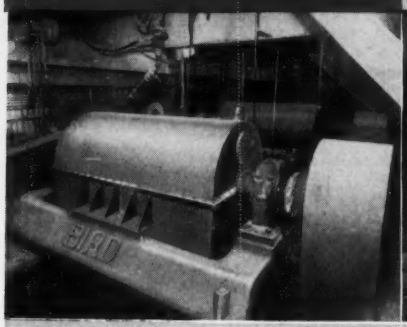
# SIX INTERESTING FILTERING PROBLEMS



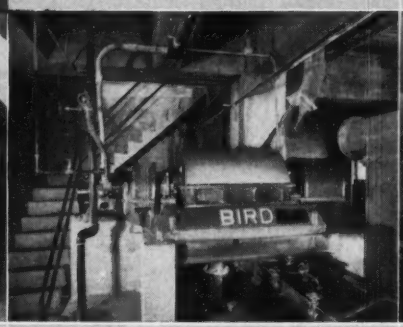
**Filtering fine salt crystals** from 80% glycerine solution at a temperature of 300°F. High temperature offers no problem to the successful use of the Bird Filter.



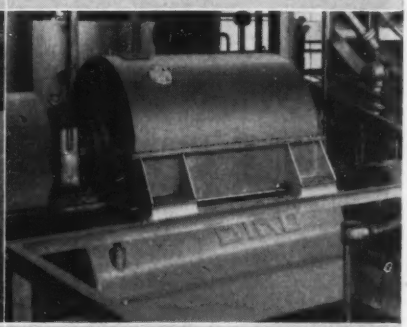
**Filtering a food product.** The Bird is the ideal filter — completely enclosed, involves no delay in process, easily sterilized.



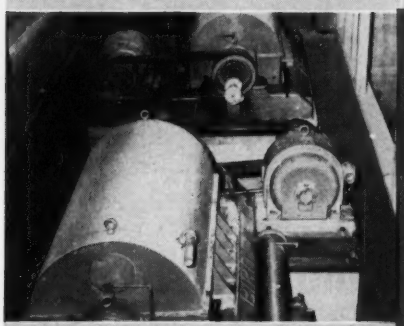
**Filtering mineral crystals,** plus 28 mesh, plus 4 abrasive hardness. The mother liquor is a hot saturated solution. A tough problem for most filters but "duck soup" for the Bird Filter.



**Recovering calcium carbonate from water softening sludge.** The feed contains valuable calcium carbonate but undesirable magnesium and iron compounds. The Bird is operated to recover the values but discard the rejects with the filtrate.



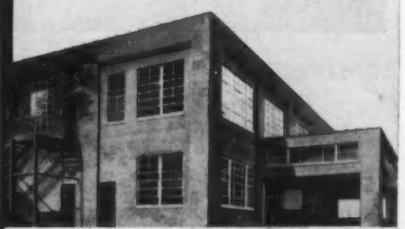
**Separation of vegetable meal from a solvent-oil miscella.** Solvent recovery is obviously important. The filter must be vapor-tight to allow recovery and provide safety. Birds are 100% tight when specified.



**Separation of potato starch from its protein water.** This job must be done quickly otherwise the starch will discolor. Material is retained in the Bird only a few seconds, no time for oxidation. High quality starch is the result.

## ONE BIRD SOLVES THEM ALL

WITH AN ASSIST FROM



THE BIRD RESEARCH AND DEVELOPMENT CENTER

These are just a few of the hundreds of different jobs being handled efficiently and economically by Bird Continuous Centrifugal Filters. On some, solids are a fraction of a micron in size; on others they are ½" or more. Feed slurries range from 3% solids or less to thickener underflows. Cost of operation and maintenance generally totals a few cents or less per ton.

Why not find out if the Bird Continuous Centrifugal Filter is the answer to *your* filtering problem? You'll get the *right* answer *quickly,* based on accurate pilot-scale test data prepared by the Bird Research and Development Center.

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**South Walpole · Massachusetts**
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**BIRD CONTINUOUS CENTRIFUGAL FILTER**
— a part of the *most complete* line of equipment for separating solids from liquids

*Another new development using*

# B. F. Goodrich Chemical *raw materials*

## CHECK THESE 4-WAY SAVINGS WITH RIGID VINYL PIPE

**Installation time cut • Heavy machinery eliminated • Two man crew does the job • No corrosion, longer life.**

Here's a hot case history of how costs were cut four separate ways by specifying plastic pipe made from Geon high impact rigid vinyl resin. The installation collects crude oil in a water flood system near Tulsa, Oklahoma.

The plastic pipe replaces 2 miles of steel pipe that failed due to salt and sulphur corrosion. A two man crew laid 640 feet of 3 inch rigid vinyl pipe made from Geon resin in an hour. No heavy machinery was used; the pipe is so light a length can be handled by one man.

Biggest saving comes from the long life of rigid vinyl pipe made from Geon resin. It withstands rough handling, won't corrode, has better chemical resistance, and costs less than many other pipe materials.

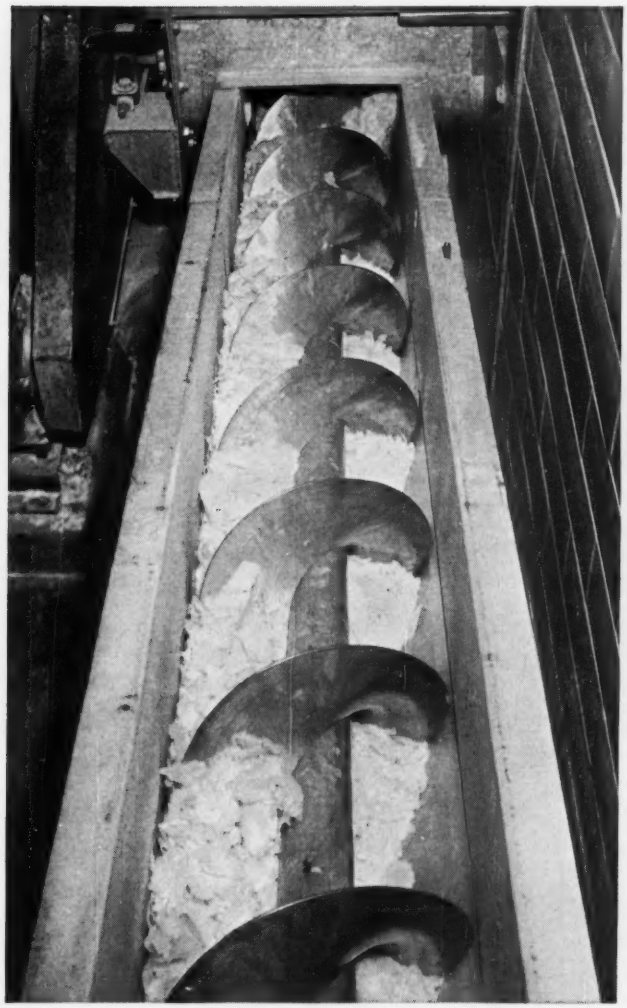
Rigid plastic pipe is but one of many products made from Geon polyvinyl materials that show similar economies in both installation and upkeep. Sheets, valves and other products used in the petroleum and chemical industries demonstrate daily the versatile qualities of Geon polyvinyl materials. For information on Geon materials, please write Dpt. BB-12, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

**GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.**

**GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors**

# LINK-BELT offers you COMPLETE, ONE-SOURCE SERVICE

## for all your screw conveyor needs



Spotless, galvanized screw conveyor (cover removed) provides efficient, sanitary means of carrying flaked, edible material to bucket elevator and further processing.

### How this 4-phase service saves you time . . . spares you details

1. **ANALYSIS AND ENGINEERING** service is provided by a district sales office in your area. From long experience, Link-Belt District Engineers can quickly ascertain the best conveying arrangement for you.

2. **COMPLETE LINE OF SCREW CONVEYOR COMPONENTS** and related elevating, conveying and power transmission equipment is your assurance that specific needs will be fulfilled most efficiently and economically.

3. **EASY ERECTION** is achieved because of prefitting, match marking, close-tolerance manufacturing and Link-Belt drawings. Link-Belt will handle entire erection assignment if you wish.

4. **SATISFACTORY PERFORMANCE** is assured when you rely on Link-Belt as a single contract source for your complete system. We will accept full responsibility for placing it in operating readiness.

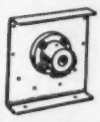
SCREWS

HANGERS

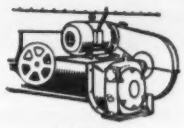
TROUGHS

SPOUTS & GATES

SHAFTS & COUPLINGS



TROUGH ENDS



DRIVES

Here's a four-point program that provides quick and easy answers to your screw conveyor problems whether minor or complex. Whatever you need in components . . . and to whatever extent you require engineering supervision—Link-Belt will devise a system "tailored" to your requirements, correlating all factors to assure you of finest performance. For more facts, call your nearby Link-Belt office.

**LINK-BELT**

THE SYMBOL OF QUALITY — LB — LINK-BELT

**SCREW CONVEYOR EQUIPMENT**

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13,913-A

# Now you can create alloys for uses like

**Special Industrial Finishes,** such as the tough enamel lining of this Airslide car for shipping flour, are made possible by new Versamid-epoxy alloys. By blending these resins, you can get hard, tenacious finishes with outstanding resistance to moisture and many solvents, as well as alkaline solutions of up to 50% concentration. For more data on the properties of these alloys. Write for General Mills Technical Bulletin 11-D.

**Bubble-Free Pottings** and castings can be made with Versamid 125 and epoxy resin alloys. They offer lasting toughness and resistance to water, chemicals and most solvents. This resin alloy features low shrinkage, excellent thermal shock resistance, high physical and dielectric strength and freedom from noxious curing agents. Write for new bulletin.

**Low-Cost Tools and Dies** like these are now being made from thermosetting blends of Versamid and epoxy resin by Champion Aircraft Corporation, St. Paul, Minn. Versamid-epoxy alloys are hard, tough, impact-resistant—excellent for tools, jigs, fixtures, master molds and like items. With low shrinkage, they conform to the mold, give amber-clear, bubble-free castings, saving time and money for Champion and many other companies.

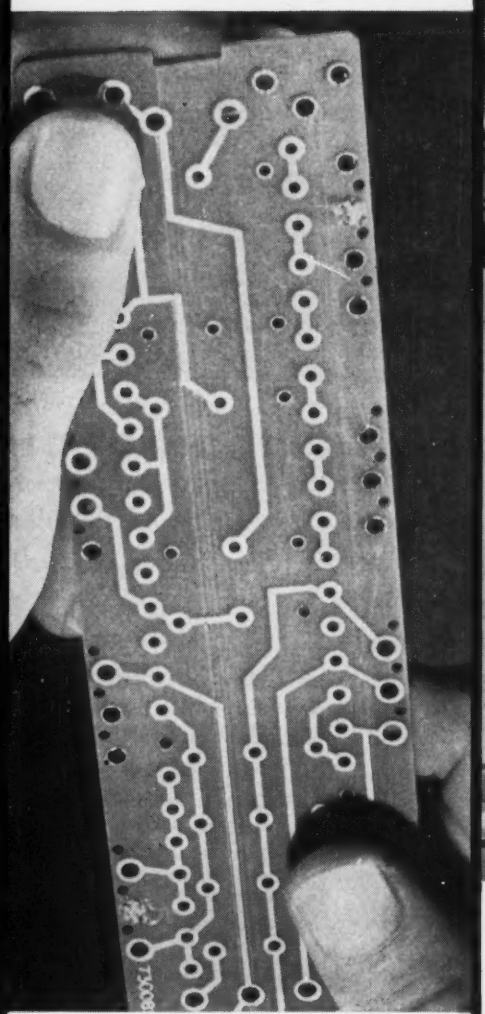
**For more information,** send for the new booklet, "Versamids . . . A Demonstration in Resin Versatility."

* ***Investigate Versamids...***

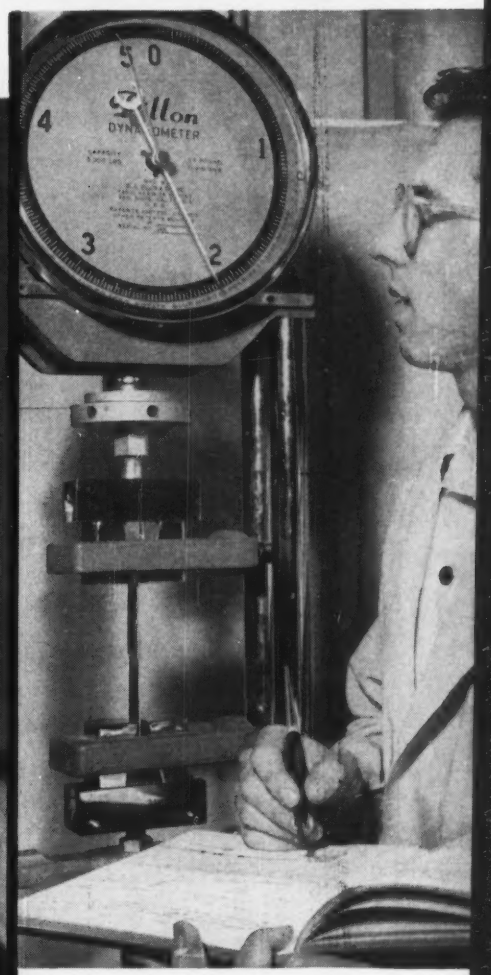
***the versatile polyamide resins made only by...***

# exciting new resin these with Versamids!*

**Rugged Laminations,** such as the plastic boat above, are among the uses for Versamid-epoxy resin alloys. These blends laminate glass fiber cloth, mat or roving. They wet the glass thoroughly, resist delamination. Other possible uses include plastic pipe, radome materials, honeycomb panels and air frame components for aircraft.



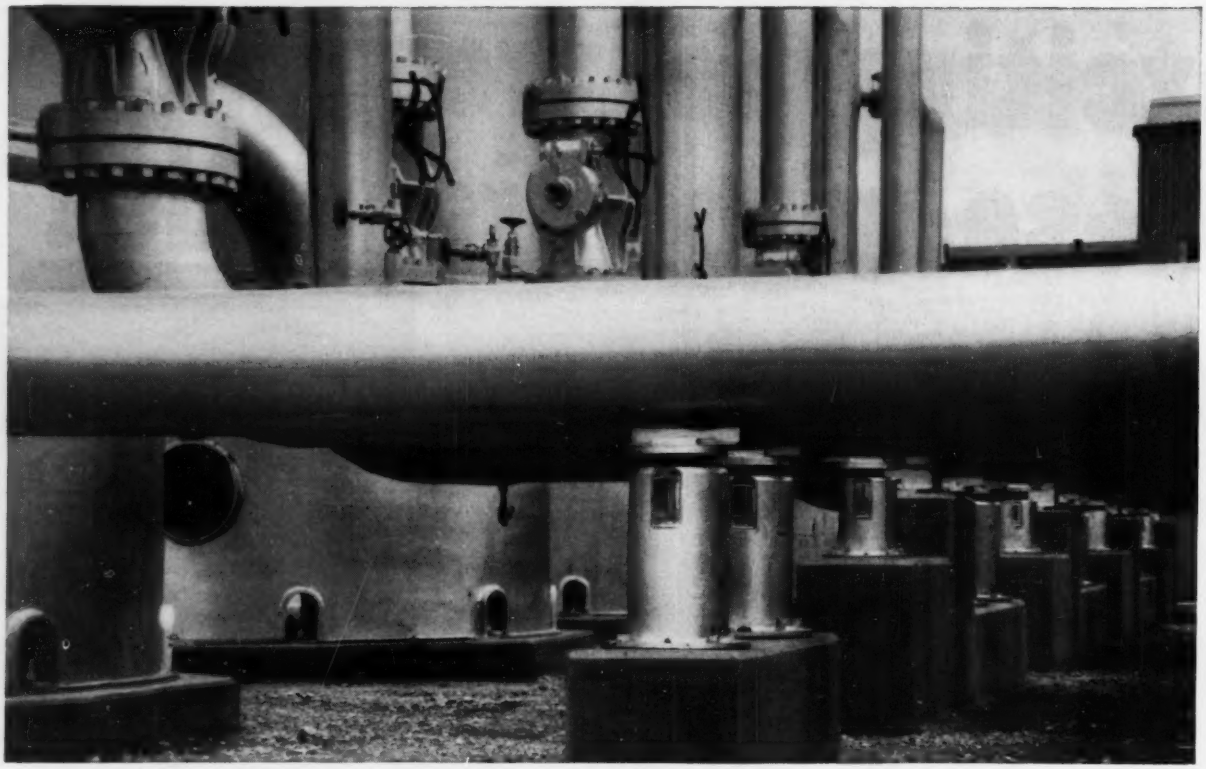
**Printed Circuit Bases** like this are a new use for Versamid 115-epoxy resin blends. Toughness, adhesion, and resistance to corrosion make them ideal for this purpose. Another blend (Versamid 100 and epoxy) bonds electrolytic metals to the bases—with contact pressure only. Formulations appear in Technical Bulletin 11-E.




**Load Bearing Adhesives** much stronger than most commercial adhesives are made from thermosetting blends of Versamid 115 and epoxy resins. They bond almost any substrate to any other...including wood, steel, aluminum alloys, sheet glass, Plexiglas, Mylar and honeycomb core materials. They show top shock resistance and offer protection against water, grease and oil, chemicals and common solvents. Write for Technical Bulletin 11-F.

**CHEMICAL DIVISION of General Mills**

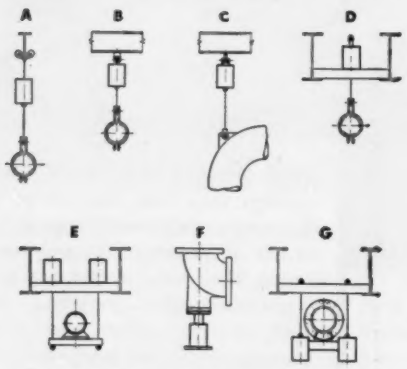
**KANKAKEE, ILLINOIS**



# For *flexible* support of piping

# *Grinnell Pre-Engineered Spring Hangers*

**AVAILABLE IN 7 TYPES FOR THESE TYPICAL APPLICATIONS**




(Type A) Rod threaded to top cap (Type B) Furnished with single lug (Type C) Two lug style (Type D) Top adjusting (Type E) Adjustable top and bottom (Type F) For base support (Type G) Trapeze assembly.

The Grinnell Pre-Engineered Spring Hanger was developed after years of experience in analyzing the problems of flexible pipe suspension systems. It is *pre-engineered* to minimize changes in supporting force over total range of movement. Consider these outstanding features:

- **Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes.**
- **Precompression* assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.**
- **Solid steel casing protects spring from damage and weather. Guides assure continuous alignment and concentric loading of spring.**
- **18 sizes available from stock for load ranges from 53 lbs. to 12,000 lbs.**
- **Available in 3 spring lengths for travel ranges of 1¼, 2½, and 5 inches.**
- **Installation is simplified by integral load scale and travel indicators.**

***Precompression is a patented feature.**

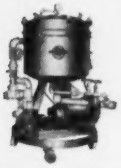
# GRINNELL

**AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPLIES**

**Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors**

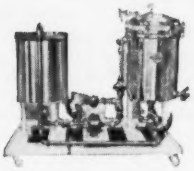
**pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems**

Laboratory filter.

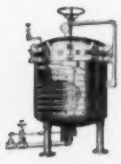


Varnish and lacquer filter.

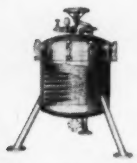
Plating solution filter (portable).



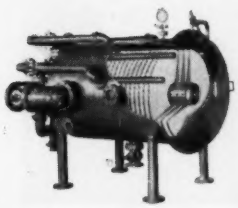
All stainless steel filter with stainless steel piping, valves, and slurry tank.



Standard horizontal plate filter.



Beer polishing filter.



Large volume water filter. Model SCJ. Single unit capacity up to 5,000,000 gal. per day.

# Sparkler Filtration Engineering

## ...the key point of quality for many products

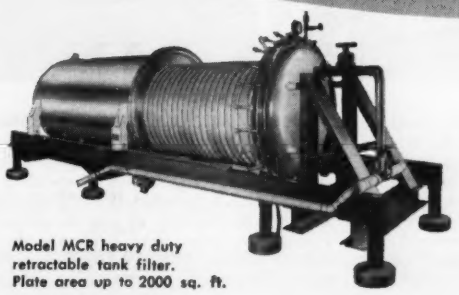
At Sparkler, engineering special adaptations of standard filters to meet particular requirements of a product is a continuous daily occurrence. Engineers working on plant layouts and production line processes can get willing cooperation and the benefit of experience in solving similar problems from Sparkler.

By concentrating on filtration engineering and manufacturing exclusively over the past 30 years Sparkler has been successful in improving filtration processes through sound engineering and with the development of hundreds of special filters particularly adapted to the requirements of food products, chemicals, pharmaceuticals, petroleum and derivatives, beer, whisky, sugar refining, electroplating and many other products as well as large volume water filtration for municipal and industrial use.

**SPARKLER MANUFACTURING CO.,** MUNDELEIN, ILL. • PHONE MUNDELEIN 6-6430

Sparkler International Ltd. with plants in Canada, Holland, Italy, Australia.
Service representatives in principal cities throughout the world.

**SPARKLER FILTERS**



Model MCR heavy duty retractable tank filter. Plate area up to 2000 sq. ft.

**Built to ASME specifications when required.**

# Life on the Chemical Newsfront

**DO-IT-YOURSELF ENTHUSIASTS** will get a helping hand with home painting from new line of ACCOSPERSE* Pigment Dispersions for rubber-base paints. These pigment dispersions mix easily, with no milling, into latex paints without streaking or specking. They have high color concentration, ideal consistency, wide compatibility with alkaline emulsions and excellent storage stability. Intermixing will provide an almost limitless array of beautiful shades and tints that are free flowing and non-streaking. **(Pigments Division)**

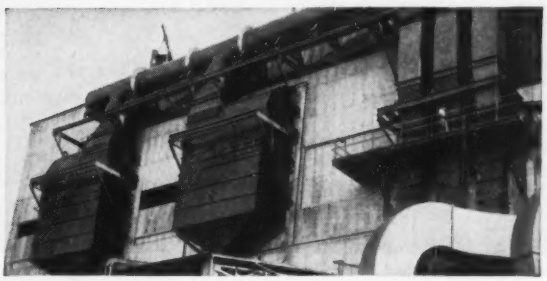
## Chemistry comes to the aid of the retailer

**NEW IDEA:** protecting merchandise from sun-fading by coating store windows with a film containing U. V. Absorber 9! Transparent to visible light, U. V. Absorber 9 soaks up ultraviolet light and changes it to harmless infrared radiation. Research in suitable film formulations has produced a number that the New Product Development Department is prepared to recommend to interested manufacturers. Other applications of this remarkable product include polyester resins, surface coatings and dyes. **(New Product Development Department, Section B)**

**WHITE FABRICS ACQUIRE STRONG SALES APPEAL** at the counter through the brilliant whiteness imparted by Cyanamid's CALCOFLUOR* White ST. Applied by the fabric finisher, this whitening agent possesses outstanding ability to absorb ultraviolet light, which is re-emitted as visible light to make the fabric much brighter to the eye. It was developed to give white and pastel fabrics the clear, clean brilliance that makes them stand out on sales counters. Mills are invited to send a swatch of their own fabric for comparison treatment. **(Organic Chemicals Division)**

**NEW PRECISION PRODUCTION PROCESSES** in ceramic manufacture, like the grinding operation illustrated, require use of binders that give high green strength to unfired pieces. The binder also should give good lubricating properties for easy mold release and internal plasticity so that complex shapes can readily be formed. Binders also must disperse thoroughly in the mixing operation and must volatilize completely on firing. In recent evaluations, HYFORM® Emulsions have proved outstanding in these essential characteristics. **(Industrial Chemicals Division, Dept. B)**

**MEDICINE THAT'S EASY TO TAKE.** An improved, recently announced ACHROMYCIN® Tetracycline dosage form is cherry-flavored liquid Pediatric Drops, which doctors may prescribe for their little patients to take "straight" from the dropper or mixed with milk, water or fruit juices. **(Lederle Laboratories Division)**



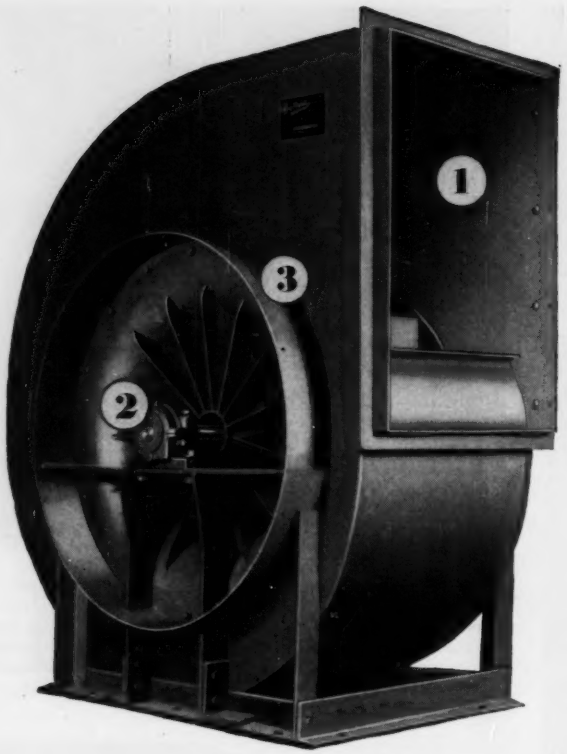
**IN THE NEW OXYGEN STEELMAKING PROCESS,** pure oxygen is blown against the surface of a molten iron bath. This violent oxydizing reaction removes impurities from the iron in the production of high-grade steel. A Pease-Anthony Venturi Scrubber is employed to prevent air pollution on the first of these operations installed on the North American Continent. This highly efficient scrubber, which removes some 30 tons per day of sub-micron iron oxide from exhaust gases, is marketed by a Cyanamid subsidiary, Chemical Construction Corp.

*Trade-mark

*Additional information may be obtained regarding these products by writing on your business letterhead to the Division of American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y., indicated in the captions.*

AMERICAN Cyanamid COMPANY
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

*Only Chemistry Can Create So Many Things That Are New*



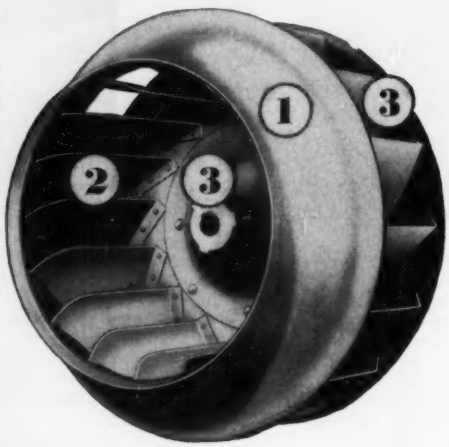

# *Double Check* EVERY FEATURE!

## ✓ ✓

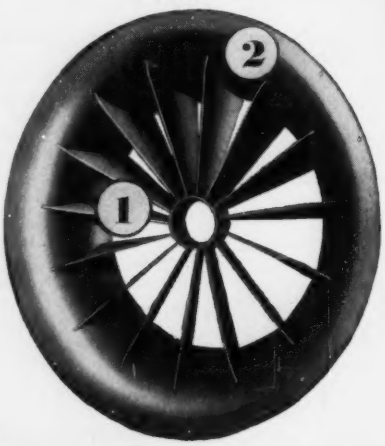
## SEE THE MANY EXTRA PERFORMANCE FEATURES THIS FAN ALONE OFFERS

**"Buffalo" Type "BL" Limit-Load VENTILATING FAN** This photo shows three of the unique features in the "BL" Fan which are giving users more for their money: (1) properly proportioned housing, streamlined for peak efficiency; (2) "Buffalo" self-aligning bearings (choice of sleeve or anti-friction type) for easiest maintenance and longest life; and (3) large, smooth inlet collar for easy duct connection.

**ROTOR FEATURES** *(at right)* Note the unusual rotor design which has made for exceptional stability and efficiency of performance. (1) Shroud is die-formed to full curvature to match inlet bell for proper air flow in wheel. (2) Backward-curved blades are die-stamped, welded and riveted for maximum strength — and insure stable air flow. (3) The heavy-gauge back plate and extra-heavy hub provide strength where it's needed.




**FREE-FLOW INLET** Note "Buffalo" inlet guide vanes (1) which assure full rated delivery with minimum turbulence even when inlet conditions are unfavorable. Inlet losses are further reduced by the smooth, die-formed inlet bell (2) which matches the wheel shroud.




*These and other features contribute to the famous "Buffalo" "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life— the best value you can recommend in a fan. For full details write for Bulletin F102.*

"Buffalo"

## BUFFALO FORGE COMPANY

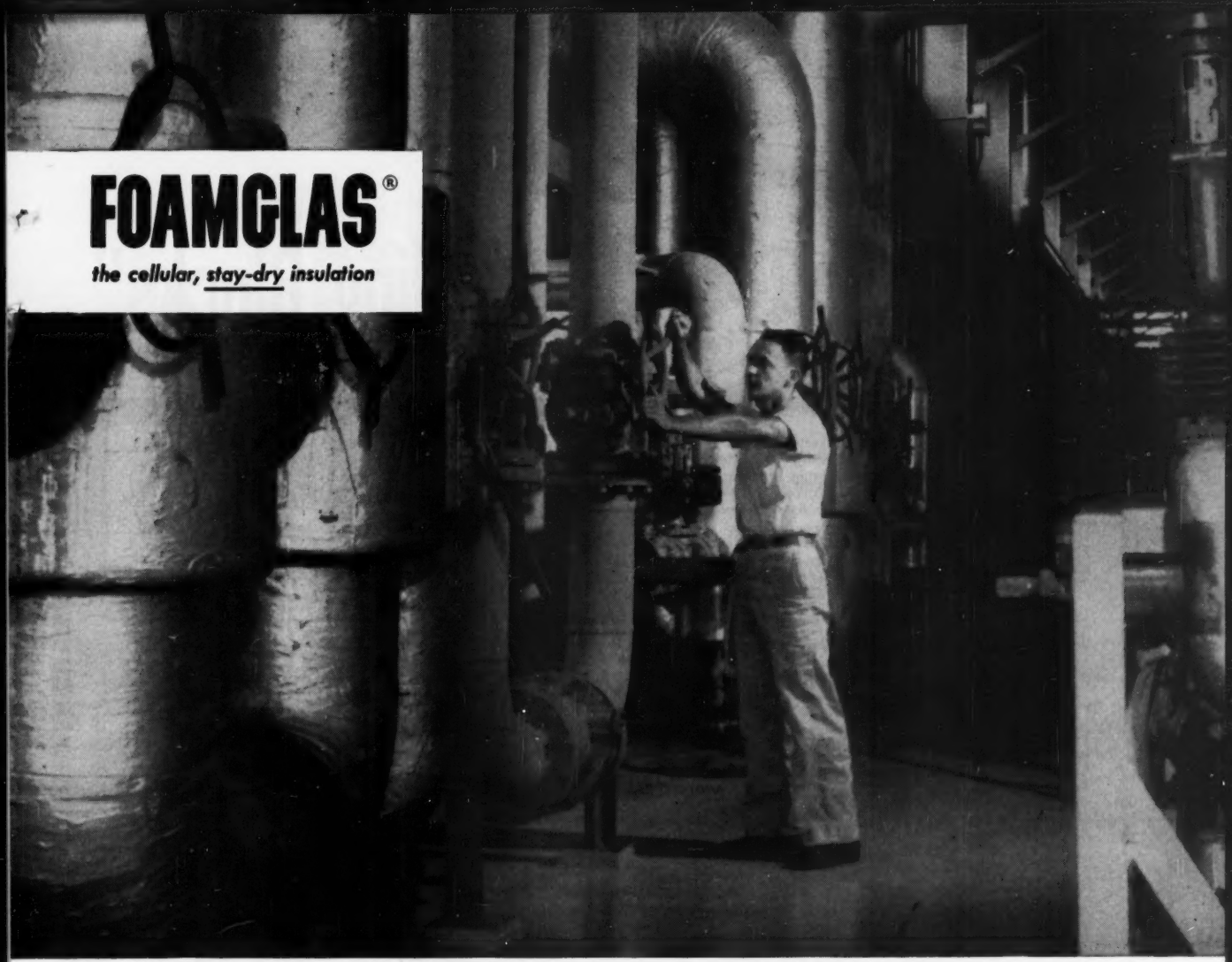
501 BROADWAY BUFFALO, NEW YORK

*PUBLISHERS OF "FAN ENGINEERING" HANDBOOK*

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

*Sales Representatives in all Principal Cities*

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING




Lion Oil Co. maintains peak ammonia production because . . .

## FOAMGLAS stays dry for constant insulating protection on refrigerated lines and vessels

Production of anhydrous ammonia at Lion Oil Company's Luling, Louisiana Plant requires extensive use of refrigerated lines and vessels. Precise control of temperatures (down to 12°F.) helps hold compressor suction pressure at 25 p.s.i. for peak production. Effective insulation is a must . . . but the area's prevailing high temperatures and humidities pose some tough insulating problems. FOAMGLAS solved them and gave Lion Oil these important benefits:

- The sealed glass cells of FOAMGLAS are unaffected by high humidity. That means *constant* insulating efficiency for dependable temperature control.
- Effective, *stay-dry* insulation prevents condensation on lines and vessels . . . thus cuts costly corrosion.
- Service to equipment is easily accomplished by cutting through the FOAMGLAS, then replacing only the insulation in the area immediately affected.

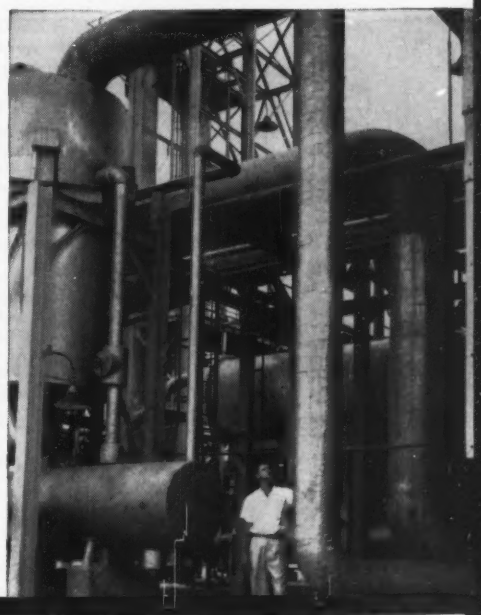
Recent inspection by Lion engineers showed FOAMGLAS was fully as effective as when originally applied in 1953. Maintenance has been negligible.

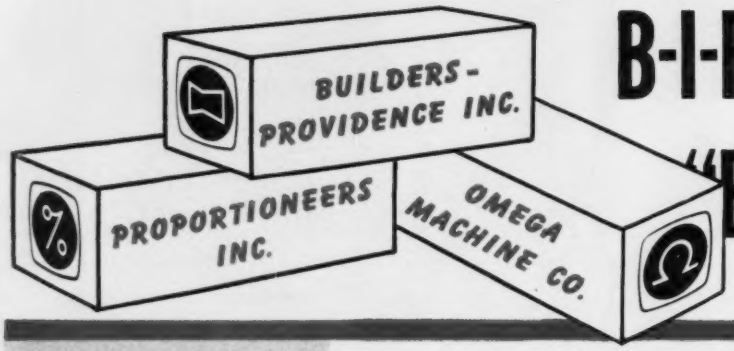
Whether you insulate piping, equipment or buildings, it will pay you to find out more about the *constant*, *long-lasting* insulating protection of FOAMGLAS. Send today for a sample and literature covering your specific needs.

**Pittsburgh Corning Corporation**
Dept. H-125, One Gateway Center
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario

**Visit our Booth No. 38 at the CHEMICAL SHOW, Philadelphia, December 5th to 9th**

Light, rigid, easily shaped and fitted with available tools . . . FOAMGLAS can be swiftly and simply applied to piping and equipment of every size and shape. Insulation Contractor: B & B Engineering and Supply Company, Inc., Houston, Texas.

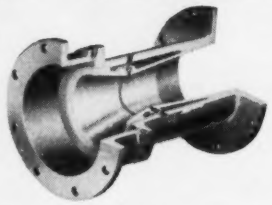





# B-I-F "Building Blocks"

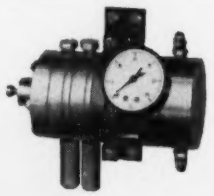
**PRIMARY ELEMENTS**

By metering flows of liquids and gases with BUILDERS Differential-Type Primary Metering Elements, process companies gain big savings in pumping costs and maintained metering accuracies. The BUILDERS-PROVIDENCE line includes the widest range of cast steel and insert type Venturi Tubes, and fabricated Flow Tubes. The new Dall Flow Tube (shown at right), because of its high pressure recovery characteristics, its stable discharge coefficient, and its self-scouring design, is gaining wide acceptance in the process, petroleum, and petro-chemical industries. Bulletins available on request.



**TRANSMITTERS**

Efficient metering of flows, liquid levels, pressures, temperatures, or weight requires accurate data transmission. BUILDERS Chronoflo (electric) and Balancel (pneumatic) Transmitters send plant operating data from remote locations to central control panels. The extensive BUILDERS line of process "building blocks" makes it possible for us to recommend the one best transmission system for each individual operating problem. Write for bulletins.



**RECEIVERS**

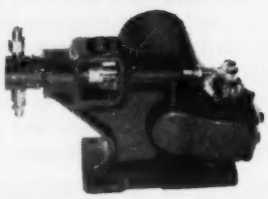
Registration of process data is handled accurately and efficiently by BUILDERS-PROVIDENCE Receiving Instruments and Control Panels. The complete line of equipment includes mechanical, electrical, and pneumatic units for all combinations of totalizing, indicating, and/or recording flow, level, pressure, temperature or weight. Instruments give straight-line readings with equal graduations over the complete operating range. Panels may incorporate standard or miniature instrumentation, as required. Send for complete information.

**CONTROLS**

BUILDERS pneumatic and electrical systems convert metering signals into control impulses for providing remote advisory data . . . for controlling pumps, valves, compressors, circuit breakers, etc. . . . for pacing chemical feeders and proportioning equipment. B-I-F continuous process systems are based on fundamental metering and controlling methods proven in hundreds and hundreds of actual process applications. Component "building blocks" add up to stable, accurate, and highly dependable process systems. May we assist you?

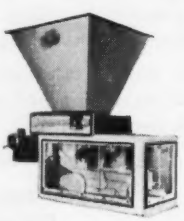
**FEEDERS LIQUIDS AND GASES**

PROPORTIONEERS Chemical Proportioning Pumps — OMEGA Liquid Loss-in-Weight Feeders and Rotodip Gravity Liquid Feeders — and BUILDERS Chlorine and Ammonia Feeders all embody simple feed rate adjustments easily adapted to automatic control systems. Dosage control may employ the start-stop method or the automatic-proportional system as demanded by process conditions. B-I-F Industries offers special materials of construction for feeding acids, alkalis, and other "difficult" liquids. Check with us today.



**FEEDERS SOLIDS**

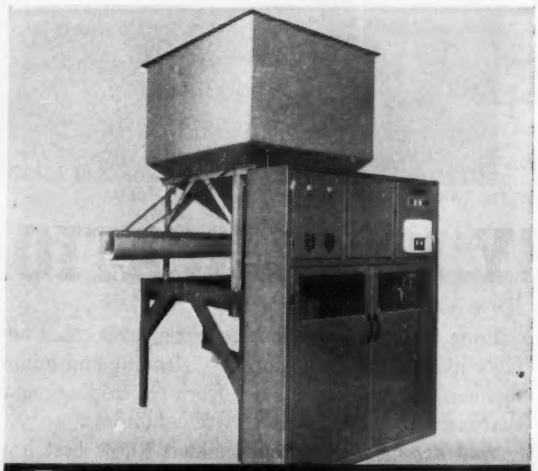
OMEGA Feeders provide controlled feeding of all types of solids at rates from a few ounces to a ton a minute. Stock units are available for feeding every type of material from floodable finely pulverized powder to granular and 1" lump sizes. BUILDERS Conveyoflo — "the flow meter for dry materials" — also available as a high-capacity feeder for conveyorized flows. Send a sample of the material you want to feed for engineering study.



# for Continuous Processing

Here's important news for you! The big economies of automation-type continuous processing are attainable through the use of B-I-F Industries "building blocks" . . . adaptable to literally thousands of industrial production problems. Here you can obtain a simple unit or a completely integrated system, including primary metering elements, instrumentation and controls, and secondary feeding and proportioning equipment — supplied by the combined forces of BUILDERS-PROVIDENCE, INC., PROPORTIONEERS, INC., and OMEGA MACHINE COMPANY. We take full responsibility for the equipment we supply — from start-up to guarantee of performance.

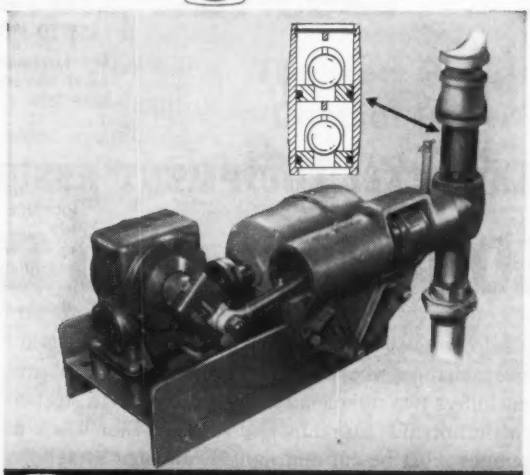
## Two new "building blocks" in the B-I-F Line...



**OMEGA MACHINE COMPANY** continuous liquid or solid Loss-In-Weight FEEDERS

- **UNLIMITED APPLICATIONS** — feed by weight all types of solids (powders, coarse particles, cut vegetables, etc.) and liquids (clear, suspensions, pulps, etc.). Also adaptable to stream weighing.
- **HIGHEST ACCURACY** — within ± ½% by weight of set feed rate over entire range.
- **BUILT-IN MEMORY** — dead weight system automatically totalizes and corrects shortages or overages.
- **A MODEL FOR EVERY USE** — Simplex and Duplex for feed rates from 1 to 60,000 #/hr. Available with remote controls (electrical, pneumatic).

For complete information on these automation tools for continuous processing, write OMEGA MACHINE COMPANY (Division of B-I-F Industries).



**PROPORTIONEERS, INC.** Vane-Guide Check Valve ADJUST-O-FEEDERS

- **EXCEPTIONAL FEEDING ACCURACY** — with Proportioneers NEW Vane-Guide check valves and minimum clearance volume cylinders . . . self-purging with straight-through design.
- **EASY-SERVICE DESIGN** — plug-in reagent end . . . other mechanical components all readily accessible and of standard design . . . reversible check valve seats.
- **POSITIVE FEED RATE SETTING** — micrometer stroke length adjustment on all standard models . . . available with in-motion rate adjustment.
- **COMPACT DESIGN** — easily installed . . . saves floor space.
- **NEW LOW COST** — check our quote on any feed rate from 0.8 GPH to 900 GPH!

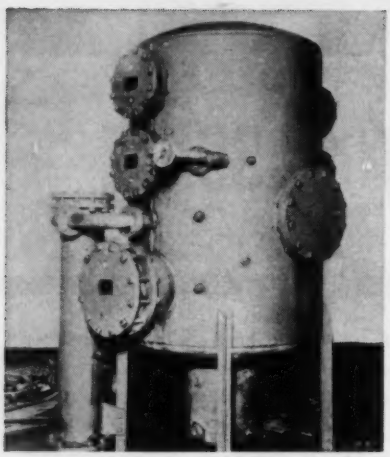
Send data on your process problem to PROPORTIONEERS, INC. (Division of B-I-F Industries) for prompt analysis and recommendations . . . or ask for the name of our nearby representative.

# B-I-F INDUSTRIES

PROVIDENCE, RHODE ISLAND

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC.
BUILDERS-PROVIDENCE, INC. • OMEGA MACHINE CO.

METERS
FEEDERS
CONTROLS



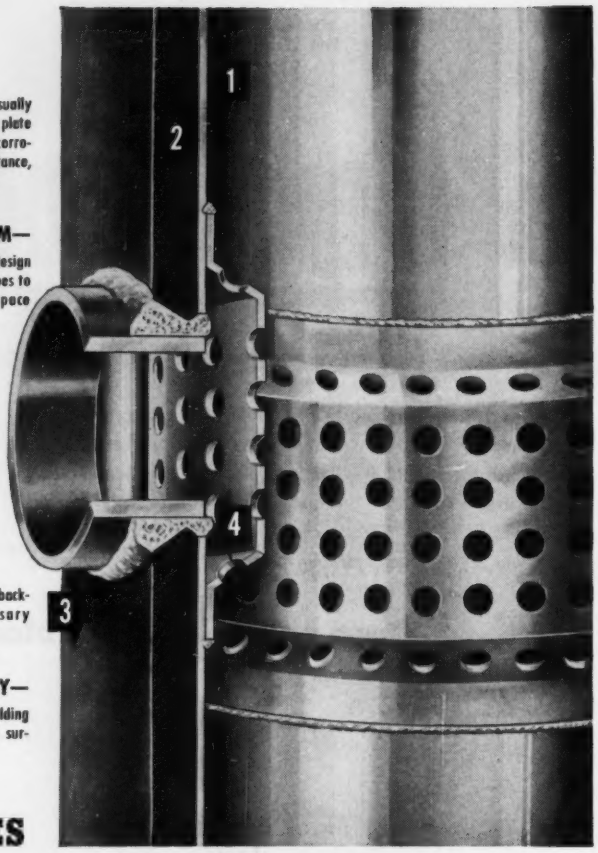
*This solvent recovery unit—reboiler, condensing and cooling elements—was fabricated of nickel-clad steel.*

**1 ECONOMY—**
High alloy layer—usually 10% or 20% of total plate thickness — assures corrosion and abrasion resistance, long equipment life.

**2 DESIGN FREEDOM—**
Integral bond allows design and fabrication of shapes to meet process and space needs.

**3 STRUCTURAL STABILITY—**
Low-cost carbon steel backing provides necessary strength and rigidity.

**4 EASY TO MODIFY—**
Normal cutting and welding will not endanger clad surface or bond.




## CLAD STEEL EQUIPMENT ASSURES

# LONG LIFE AND EASY MODIFICATION

To help you overcome the rapid obsolescence caused by process changes when first costs are high, clad steel equipment offers two unique advantages. First, clad steel construction permits easy tank and vessel revision where new openings must be cut and flanges, pipes or attachments welded on. This means you can design for extra-long service life. The bond between cladding and backing will not tear away and allow harmful seepage.

Second, you get long-life protection from corrosion, abrasion and product contamination—all the advantages of solid, high-alloy construction—with savings up to 50% in material costs. The ASME Code permits full gage consideration for design purposes because cladding and backing are bonded over their entire surface.

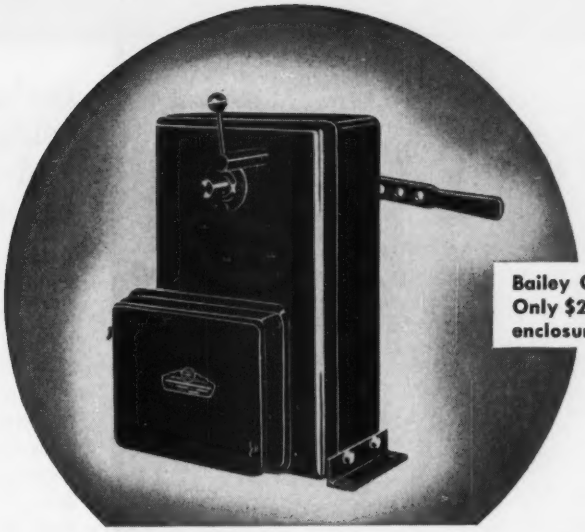
Long life and low-cost protection, plus other advantages like fast heat transfer, easy cleaning and minimum maintenance, can be obtained from 16 cladding materials that meet a wide range of service conditions.

And *qualified* equipment builders know best how to apply these to your new processing equipment. By working with your own engineers and consultants from the start, they can help you get longer equipment life at lower cost. Lukens offers the widest available range of clads—stainless, nickel, Inconel, Monel, copper—and cooperates with fabricators in helping you to select the type best suited to your processing needs. If you would like more information, consult one of your builders or write Manager, Marketing Service, Lukens Steel Co., 749 Lukens Building, Coatesville, Pa.

**LUKENS CLAD STEELS**

**STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD**

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE



Bailey Control Drive, Type AC44P Model 200. Only $210.00 F.O.B. Cleveland, complete with enclosure, positioning relay and hand operator.

# Want Better Flow Characteristics from Your Regulating Devices?

This new, small, piston-operated Bailey Control Drive will improve the flow characteristics of butterfly valves, dampers, hydraulic couplings, feeders and similar regulating devices. Adjustment is simple; any desired relation between drive motion and pneumatic signal may be secured.

You can install this compact pneumatic drive power unit in any position on a column, pipe, or flat surface—and connect it to the regulating device with standard Bailey linkage, available from stock.

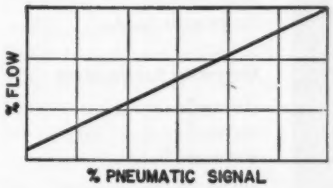
Speed (time required for full travel) is adjustable to suit your requirements. Bailey Control Drives operate on standard SAMA pneumatic signal ranges of 3 - 15 or 3 - 27 psig.

**AVAILABLE FROM STOCK in 3 standard sizes**

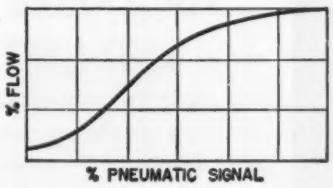
| Type | Piston Dia. Inches | Piston Stroke Inches | Torque ft-lb | Max. Travel Degrees | Approx. Dimensions Inches |
|---|---|---|---|---|---|
| AC816 | 8 | 16 | 1500 | 90 | 13 x 27 x 51 |
| AC68 | 6 | 8 | 400 | 90 | 13 x 19 x 34 |
| AC44 | 4 | 4 | 75 | 75 | 10 x 11 x 19 |

P-28

## The New Bailey Control Drive gives you THIS—




## instead of THIS




**BAILEY METER COMPANY**

1054 IVANHOE ROAD

CLEVELAND 10, OHIO

*Complete Controls for Process Plants*

BAILEY METERS

*Controls for*

TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW LEVEL
RATIO

**FOR MORE INFORMATION**

FILL OUT AND MAIL

☐ I am interested in Bailey Control Drives. Mail me Spec. P81-1.

☐ I am interested in Bailey Control Linkage. Mail me Spec. P81-5.

Name _____

Title & Company _____

Street & Number _____

City & Zone _____ State _____

# for your information...

brief summaries of helpful product news

## These Monsanto Rubber Chemicals...

**Antioxidants**
Flectol* H
Santoflex* AW
Santoflex DD
Santoflex 75
Santowhite* MK
Santowhite Crystals
Santowhite L
Santowhite Powder

**Mercapto Accelerators**
El-Sixty*
Mertax*
Santocure*
Santocure NS
Thiofide* (MBTS)
Thiofide S (seeds)
Thiotax* (MBT)

**Aldehyde Amine Accelerators**
A-32
A-100

**Guanidine Accelerators**
DPG
Guantal*

**Ultra Accelerators**
RZ-50*-A
RZ-50*-B
R-2 Crystals
Ethyl Thiurad*
Mono Thiurad*
Thiurad*

**Special Materials**
A-1
Santovar*-A
Sulfasan*-R
Insoluble Sulfur 60

**Reodorants**

**Colorants**

**Wetting Agents**

## ...Help Make Better Rubber Products!

Would the prevention of cracking and *deterioration caused by ozone* make your product a better, more salable one? *Santoflex AW can give you this protection.*

Would *more thoroughly* and *rapidly dispersed MBTS* streamline your production process and make it more economical? *Then specify Monsanto MBTS.*

And did you know: Monsanto Santocure is the original commercially produced sulfenamide-type accelerator; with Santocure NS, it is considered a standard of the rubber industry.

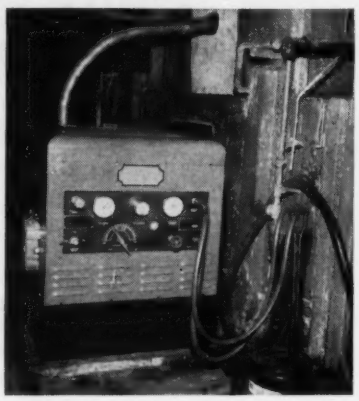
Santocure NS has similar behavior in compounded rubbers as Santocure and is characterized by excellent delayed action which gives greater freedom from scorch.

WHATEVER YOUR PROBLEM involving rubber chemistry, call on Monsanto, where experience, knowledge, product range and dependable service can help you pin down the answer. We would like to send you, without charge, our comprehensive catalog, "Chemicals for the Rubber Industry." For your copy, check the handy coupon.

## Boiler leak detector using Monsanto Pydraul prevents fuel waste

A fire-resistant "fog" sprayed into either hot or cold boiler furnaces is proving one of industry's most effective devices for detecting boiler setting and casing leaks.

Pydraul* F-9, developed originally by Monsanto as a fire-resistant hydraulic fluid, is specified as the fogging agent by the Products Division of Todd Shipyards Corporation, Brooklyn, N. Y., for use in the company's industrial fog applicators.



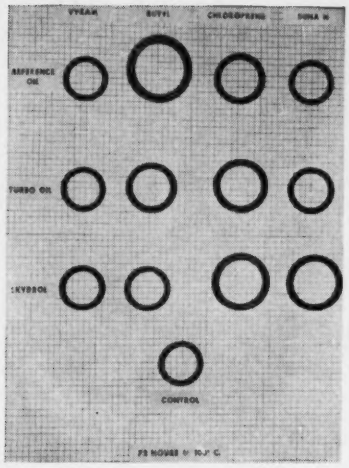
**Testing for boiler leakage. Pydraul fire-resistant fluid, the fogging medium, assures complete freedom from fire hazard.**

Consolidated Edison of New York, with whom Todd Shipyards' Products Division cooperated in developing this revolutionary form of boiler leak detection, has conservatively estimated that annual savings in fuel and maintenance costs will be in the neighborhood of $100,000.

While previous methods of determining boiler leakage—candles held along boiler casings, burners, boiler furnace doors, etc.; soapy water and smoke bombs—were used with some success, they were inefficient and costly in man power and equipment down-time during tests.

For more information about Pydraul fire-resistant fluid and Todd Industrial Fog Applicator (TIFA) equipment, check the coupon.

*Note: Pydraul F-9 is the first and only fire-resistant hydraulic fluid listed by Underwriters' Laboratories, Inc.*




**Vyram O-rings (vertical column, far left) show no signs of swell or distortion even after prolonged immersion tests.**

## New elastomer highly resistant to hydraulic fluids and many solvents

Monsanto's Vyram* is a remarkable synthetic elastomer which resists the swelling action of both synthetic and petroleum-base hydraulic fluids and lubricants.

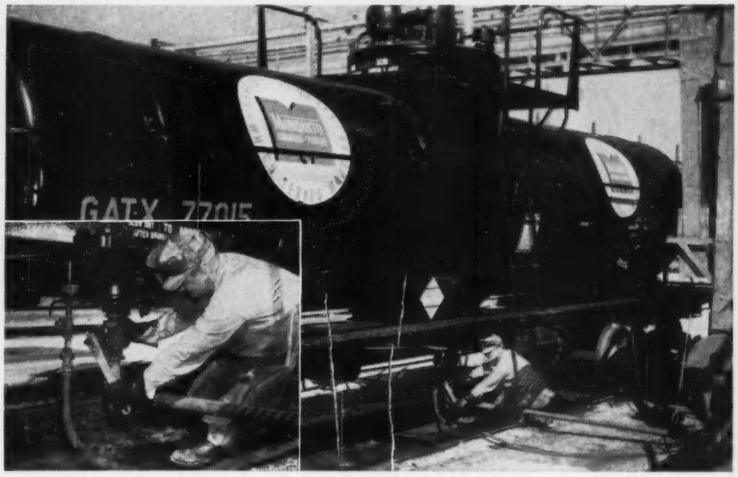
Proved by extensive tests, Vyram has demonstrated its ability to withstand the chemical action of a variety of solvents and other fluids.

Comprehensive immersion data on Vyram in alcohols, aldehydes, amines, esters, ether, glycols, hydrocarbons, ketones, oils, substituted hydrocarbons and functional fluids are presented in a new technical bulletin just issued on Vyram.

Also included in the bulletin are physical properties, compounding data, processing information and a summary of properties imparted by various curative systems.

If you manufacture elastomeric seals, Vyram may be just the material you've been looking for. For technical information, check the coupon and mail today.

## Special service! Steam-jacketed outlets speed bottom unloading of Monsanto Phenol tank cars




For phenol users equipped to handle bottom unloading, Monsanto offers shipment in special tank cars featuring steam-jacketed outlets to facilitate unloading in cold, icy weather.

Special advantages of the heated outlet:

1. Faster unloading: steam confined to localized area for maximum heating with minimum steam. Result: fast, smooth flow of molten phenol from tank car to storage tank.
2. Convenient location for hook-up: hook-up time and labor costs substantially reduced.
3. Safer, easier handling: minimizes climbing on slippery tank cars during winter weather.

Why not specify in your next order "Monsanto Phenol—please ship in jacketed bottom-outlet cars."

*Fact-filled booklet available*

Now available from Monsanto is a handy, pocket-size booklet entitled "The Handling of Phenol."

It was carefully designed to be of practical value to the men handling phenol. Liberally illustrated with charts, graphs and drawings, the booklet covers such important factors as protective clothing, unloading, storing, handling and many other vital points.

For your copy, check the coupon.

*Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS - PLASTICS
WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

MONSANTO CHEMICAL COMPANY
808 North 12th Street, St. Louis 1, Mo.

12/55

Please send me the items checked below:

- ☐ Booklet, "Chemicals for The Rubber Industry"
- ☐ "Vyram Synthetic Elastomer," Tech. Bul. No. ODB-55-21
- ☐ Booklet, "Pydraul F-9"
- ☐ Booklet, "The Handling of Phenol"
- ☐ More information about boiler leak detection methods using Pydraul.

Name..... Title.....

Company.....

Street.....

City..... Zone..... State.....

# REDLER

## Conveyor-Elevators Move

# salt for brine

## at Armour

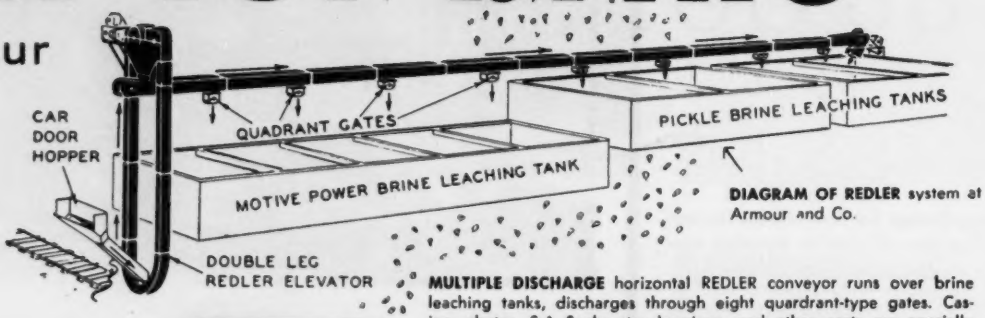
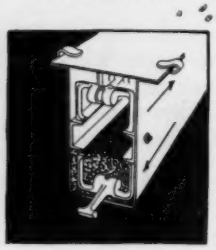
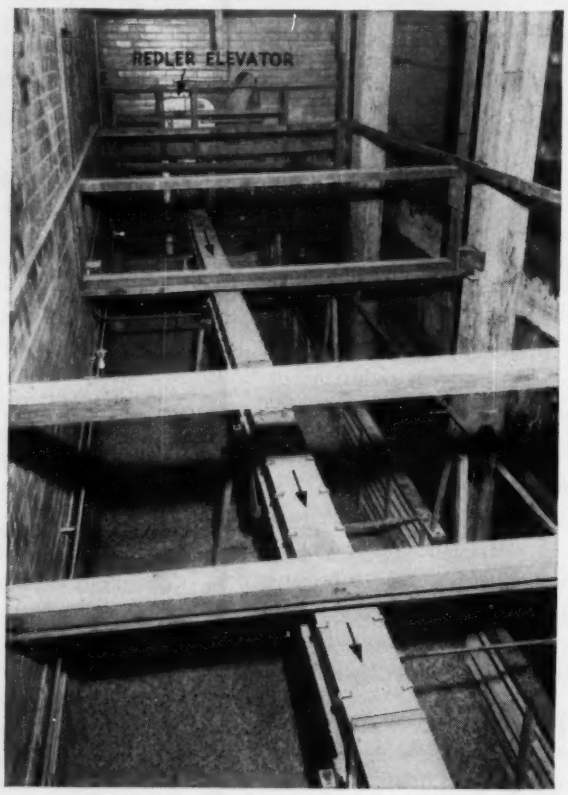



**DIAGRAM OF REDLER** system at Armour and Co.

**MULTIPLE DISCHARGE** horizontal REDLER conveyor runs over brine leaching tanks, discharges through eight quardrant-type gates. Casing, chutes, S-A Sealmaster bearings, and other parts are specially treated for corrosion resistance.



**SECTION THROUGH REDLER CONVEYOR** shows how material is moved in jam-proof, sealed flow.




Rock salt moves from box cars to brine leaching tanks at Armour's St. Paul, Minn., plant quickly and at low cost—thanks to S-A REDLER Conveyor-Elevators. The REDLER system shown at right and diagramed above is the third at this plant. Two others have been successfully handling the highly corrosive salt since the early Thirties.

There's a good possibility REDLERS are the best answer to *your* bulk handling problem, too. Features include sealed conveying in any direction without dust, jamming, degradation or contamination. Write for full details.

**An experienced S-A engineer will be glad to advise you on any phase of bulk materials handling. No obligation.**

SINCE 1901 S-A STEPHENS ADAMSON MFG CO

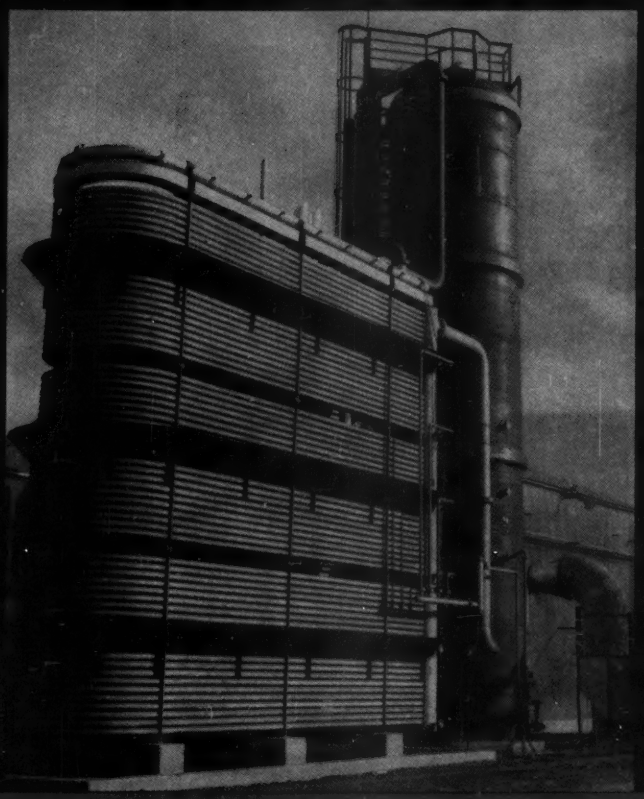
## STEPHENS-ADAMSON MFG. CO.

3 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif. • Belleville, Ontario

**Engineering Division**
Specialists in the design and manufacture of all types of bulk materials conveying systems

**Standard Products Division**
A complete line of conveyor accessories, centrifugal loaders—car pullers—bin level controls

**Sealmaster Division**
A complete line of industrial ball bearing units available in both standard and special housings



*designed and built by . . .*

C & I

# world's largest*
## single unit nitric acid plant

*220 tons of nitric acid a day is the output of this new C & I plant built for Mississippi River Chemical Co., Div. of Mississippi River Fuel Corp. near St. Louis, Missouri. The plant uses 2 Clark steam turbine driven centrifugal compressors with expanders that recover approximately ⅔ of the power required to operate the plant. Operating costs . . . greatly reduced; capacity . . . a record!

If you are considering nitric acid or expanding your present facilities it will pay you to consult C & I. For only C & I has actually designed and constructed large plants of this type that are in operation today.

C & I designs and builds Complex Fertilizer Plants, Ammonium Nitrate Solutions and Solids Plants (Stengel Process or Prilling), and Ammonium Nitrate Ammonia Solutions Plants.

*C & I's new Ammonium Nitrate Plant designed and built for Mississippi River Chemical Co. near St. Louis. Capacity: 280 tons per day of prilled Ammonium Nitrate and 200 tons per day of Nitrogen Solutions.*

C&I

THE CHEMICAL AND INDUSTRIAL CORP.

CINCINNATI 26, OHIO

*Specialists in Plants for the Processing of Anhydrous Ammonia Available throughout the World*

# ALUMINUM

## ...the heat exchanger tubing that COSTS LESS, resists corrosion, provides maximum heat transfer

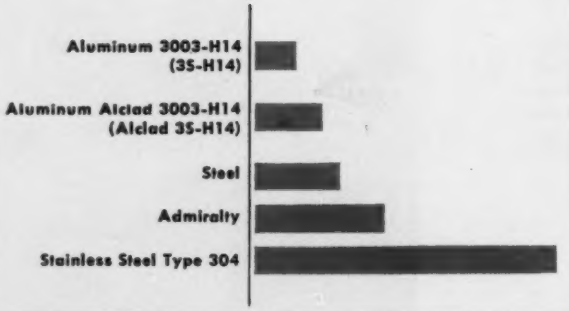
Two important advantages of aluminum make it the natural choice for heat exchanger tubing for most applications. The charts below illustrate cost savings and length of life that aluminum offers. In addition, aluminum heat exchanger tubing provides improved heat transfer rates due to its exceptional non-fouling characteristics.

To help you put these advantages to work in your heat exchanger operations, Reynolds engineers have prepared a sixteen page brochure titled "Reynolds Aluminum for Heat Exchangers." This booklet covers detailed engineering information necessary to the best use of aluminum in many types of heat transfer. The brochure, dealing with some of the varied application possibilities, is reproduced on the adjoining page. Copies of the brochure may be obtained by using the coupon in the lower right hand corner of this advertisement.

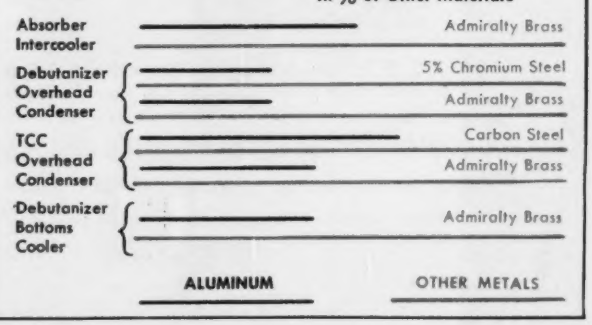
*See Reynolds New Program "Frontier"—Sundays on NBC-TV.*

# REYNOLDS

**Comparable Unit Cost of Most Frequently Used Heat Exchanger Metals**




**Comparison of Aluminum Service Cost in % of other materials**



REYNOLDS ALUMINUM
for HEAT EXCHANGERS
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Description . . . . . 2
Advantages . . . . . 2
Application Information . . . . . 2
Design Information . . . . . 4
Friction Factors . . . . . 6
Fabrication Considerations . . . . . 12
TABLES
Suggested alloy recommendations for aluminum heat exchanger construction . . . . . 7
Specifications for Reynolds Aluminum drawn heat exchanger tubes . . . . . 8
Nominal chemical compositions for wrought aluminum alloys . . . . . 8
Maximum allowable stress values for aluminum . . . . . 9
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Typical tensile properties of wrought aluminum alloys at elevated temperatures . . . . . 11
Thermal expansion of wrought aluminum alloys . . . . . 11
Low temperature properties of wrought aluminum alloys . . . . . 12
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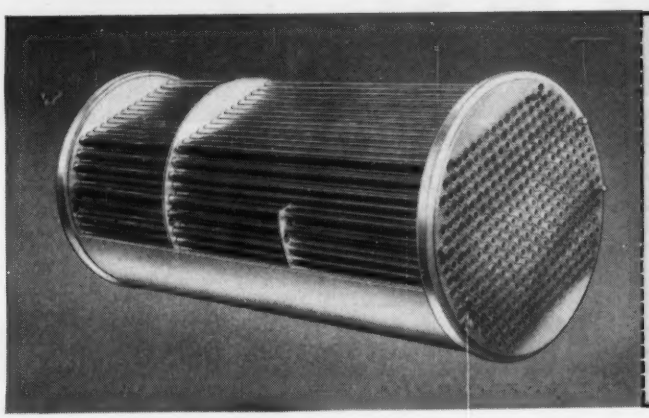
# ALUMINUM



**REYNOLDS METALS COMPANY**
**P.O. Box 1800—CJ**
**Louisville 1, Kentucky**

Please send me your 16-page brochure entitled "Reynolds Aluminum for Heat Exchangers"

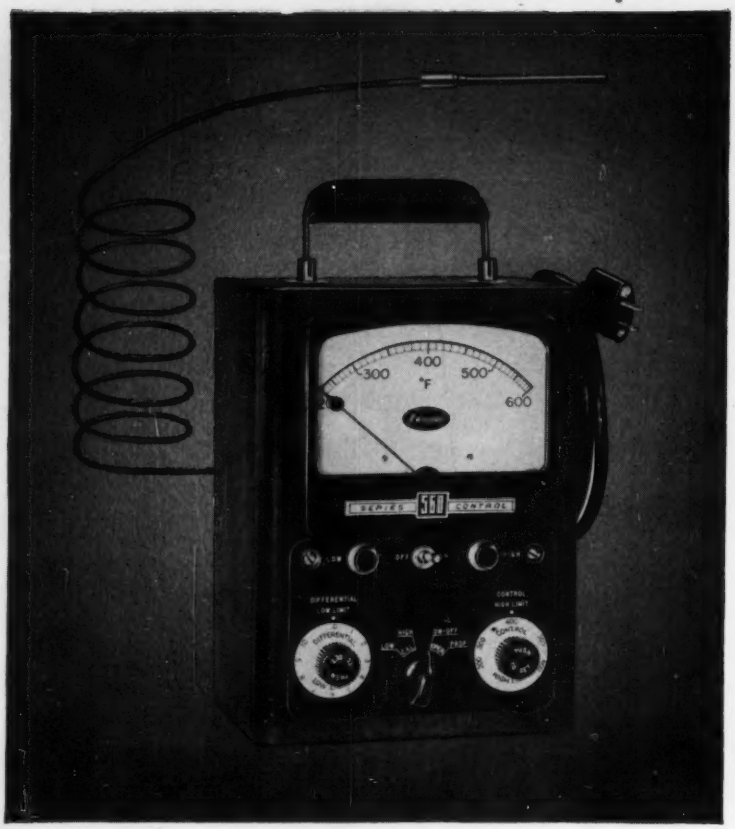
Name_____

Company_____ Title_____

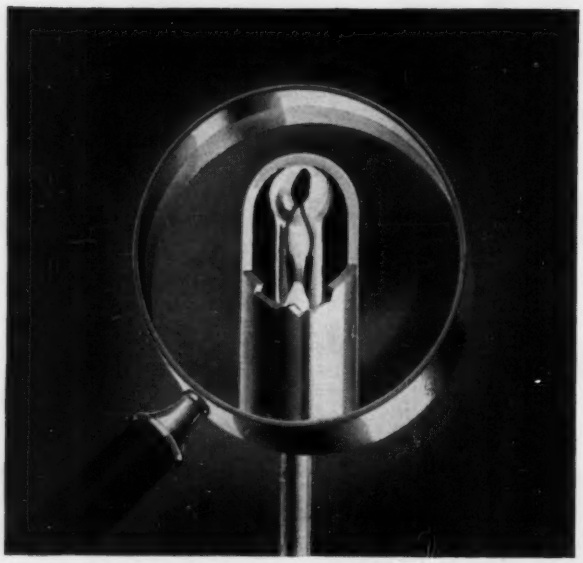
Street Address_____

City_____ Zone____ State_____

# Fenwal first to apply thermistor principle to indicator-controller design




**1. A GREAT STEP FORWARD.** In the new *Series 560*, Fenwal engineers have developed the first Indicator-Controller to use a thermistor as the sensing element — an instrument whose many new advantages make it an outstanding value for both industrial and laboratory applications. For example, a selector switch permits either time-proportioning or on-off control, with response accuracy being well within 0.25% of full scale. And its much greater simplicity, excellent stability and ease of maintenance are typical of the Fenwal engineering that has sparked so much progress in the field of temperature control and detection.



**2. NO RESISTANCE BULB, NO THERMOCOUPLE.** Instead, the *Series 560* employs a super-sensitive thermistor, hermetically sealed in glass and encased in a stainless steel tube. This new sensing element not only probes temperatures from 200° to 600°F with closest accuracy; it also simplifies operation and maintenance by eliminating complex circuitry. Easily adjusted to any desired differential.

**3. GET THE WHOLE STORY.** Get all the facts on the exceptional accuracy, stability and ease of maintenance of the new *Series 560* Indicator-Controller. You'll find our comprehensive bulletin MC123 on this ahead-of-the-parade instrument well worth reading. For your copy, **write to Fenwal Incorporated, 1612 Pleasant Street, Ashland, Mass.**

**Fenwal** Controls Temperatures
*... Precisely*

NM
$CH_3NO_2$

NE
$CH_3CH_2NO_2$

# THE CSC NITROPARAFFINS

# New Stars

## to give new direction to the chemical industry

2-NP
$CH_3CHNO_2CH_3$

1-NP
$CH_3CH_2CH_2NO_2$

**PHYSICAL PROPERTIES**

| | NM (Nitromethane) $CH_3NO_2$ | NE (Nitroethane) $CH_3CH_2NO_2$ | 1-NP (1-Nitropropane) $CH_3CH_2CH_2NO_2$ | 2-NP (2-Nitropropane) $CH_3CHNO_2CH_3$ |
|---|---|---|---|---|
| Molecular Weight | 61.04 | 75.07 | 89.09 | 89.09 |
| Boiling Point at 760mm, °C | 101.2 | 114.0 | 131.6 | 120.3 |
| Azeotrope with Water, bp, °C | 83.6 | 87.1 | 91.2 | 88.4 |
| NP in azeotrope, % by weight | 77.1 | 73.6 | 64.5 | 73.1 |
| Vapor Pressure at 20°C, mm | 27.8 | 15.6 | 7.5 | 12.9 |
| Evaporation Rate, by volume* | 139.0 | 121.0 | 88.0 | 110.0 |
| Freezing Point, °C | −29.0 | −90.0 | −108.0 | −93.0 |
| Specific Gravity at 20/20°C | 1.139 | 1.052 | 1.003 | 0.992 |
| Density of Vapors (air = 1.00) | 2.11 | 2.58 | 3.06 | 3.06 |
| Weight per U.S. Gallon at 68°F, lb | 9.48 | 8.75 | 8.35 | 8.24 |
| Coefficient of Expansion, per °F | 0.00064 | 0.00062 | 0.00056 | 0.00058 |
| Refractive Index, $n_D$ at 20°C | 1.3818 | 1.3916 | 1.4015 | 1.3941 |
| Surface Tension at 20°C, dynes/cm | 37.0 | 31.3 | 30.0 | 30.0 |
| Heat of Vaporization at 30°C, calc., cal/g | 143.3 | 124.8 | 107.3 | 104.4 |
| Heat Capacity at 25°C, cal/g | $0.422^{30°C}$ | 0.441 | 0.471 | — |
| Dielectric Constant at 30°C | 35.76 | 28.00 | 23.22 | 25.48 |
| Ignition Temperature, °F | 785.0 | 778.0 | 789.0 | 802.0 |
| Flash Point, °F (Tag Open Cup) | 112.0 | 106.0 | 120.0 | 103.0 |
| pH 0.01M Aqueous Solution at 25°C | 6.4 | 6.0 | 6.0 | 6.2 |
| Solubility in Water at 20°C, % by volume | 9.5 | 4.5 | 1.4 | 1.7 |
| Solubility of Water in NP at 20°C, % by volume | 2.2 | 0.9 | 0.5 | 0.6 |

*N-Butyl Acetate = 100

**NP DERIVATIVES ALSO AVAILABLE**

AB (2-Amino-1-butanol)
AEPD (2-Amino-2-ethyl-1, 3-propanediol)
AMPD (2-Amino-2-methyl-1, 3-propanediol)
AMP (2-Amino-2-methyl-1-propanol)
NB (2-Nitro-1-butanol)
NEPD (2-Nitro-2-ethyl-1, 3-propanediol)
NMPD (2-Nitro-2-methyl-1, 3-propanediol)
NMP (2-Nitro-2-methyl-1-propanol)
ALKATERGES
TRIS AMINO (Tris [hydroxymethyl] aminomethane)
TRIS NITRO (Tris [hydroxymethyl] nitromethane)
HAS (Hydroxylammonium Acid Sulfate)
HC (Hydroxylammonium Chloride)
HS (Hydroxylammonium Sulfate)

SAMPLES ON REQUEST

Here are the Nitroparaffins – NM(Nitromethane), NE(Nitroethane), 1-NP(1-Nitropropane) and 2-NP(2-Nitropropane). These four NP's have a potential range of usefulness unequalled by any other group of organic chemicals! CSC's new Nitroparaffin plant at Sterlington, La. is now in full production. Additional facilities for increased volume of NP derivatives are nearing completion.

In many cases, they provide better and more economical methods of manufacturing well-known and widely used industrial chemicals. However, the majority of the reactions yield entirely new compounds. There is practically an unlimited number of products which can be prepared from the NP's. As solvents, they present an unusual combination of properties – they are medium-boiling, mild-odored and, most important of all, they have strong solvent power for a wide variety of substances, including many coating materials, waxes, resins, gums, dyes, fats and oils, and numerous organic chemicals. The CSC Nitroparaffins are chemistry's newest stars. They give new direction to the production of old products and the development of new.

**COMMERCIAL SOLVENTS CORPORATION**

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CSC INDUSTRIAL CHEMICALS

**Wagner®**
**ELECTRIC MOTORS**
**...the choice of leaders in industry**

**New NEMA Frames**
**Standard and Explosion-proof**

**Type EP**
**215 Frame**

# Wagner Totally-Enclosed Fan-Cooled Motors

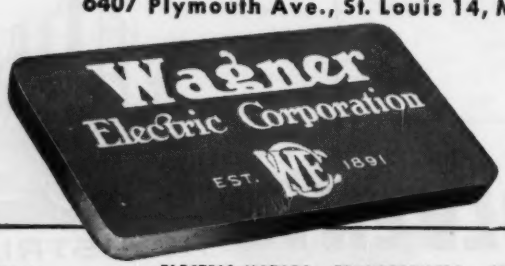
## *cut maintenance time and costs*

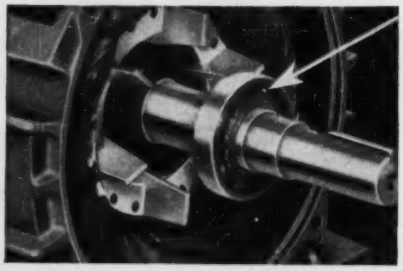
Check the features of the new *Wagner Type EP Totally Enclosed Motor.* They spell the difference between needless expenditures in maintenance time and costs . . . and a definite savings in motor upkeep and repairs. You'll find that for general industrial use where dust, dirt, filings, abrasives, steel chips or moisture are present, the Wagner Type EP Motor gives steady, troublefree performance and longer service life.

*Wagner Type JP Explosion-Proof Motor* . . . has the same quality construction as the Type EP — plus added features which make it completely safe to operate where explosive dust, gases or vapors are present.

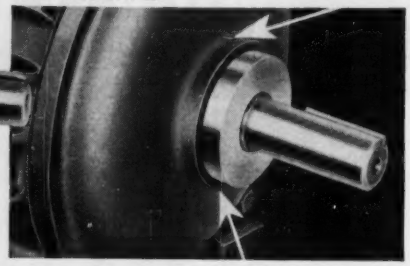
Both Type EP and JP Wagner motors are available in ratings up to 250 horsepower. For complete information, just call the nearest of our 32 branch offices, or write for Bulletin MU-203.

**Wagner Electric Corporation**
**6407 Plymouth Ave., St. Louis 14, Mo.**

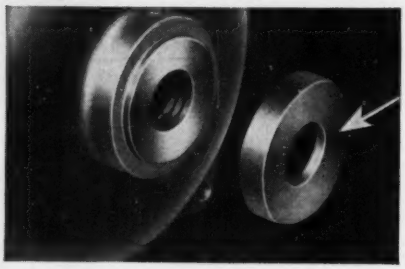


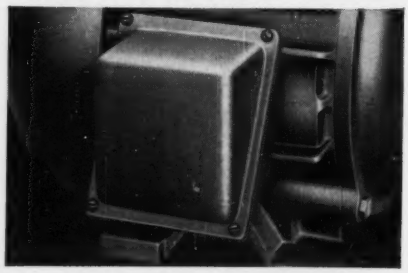
**1 HEAVY-DUTY BALL BEARINGS**—Highest quality bearings of more than ample capacity provide long, troublefree service.



**2 BEARINGS CAN BE RE-LUBRICATED**—Wagner motors can be re-lubricated when necessary to prolong bearing life.



**3 BEARINGS STAY CLEAN**—Both ends of these motors are equipped with running shaft seals, a machined collar mounted on the motor shaft.



**4 EASY TO CONNECT**—Large diagonally-split conduit box provides ample room for making connections. Leads are permanently identified.

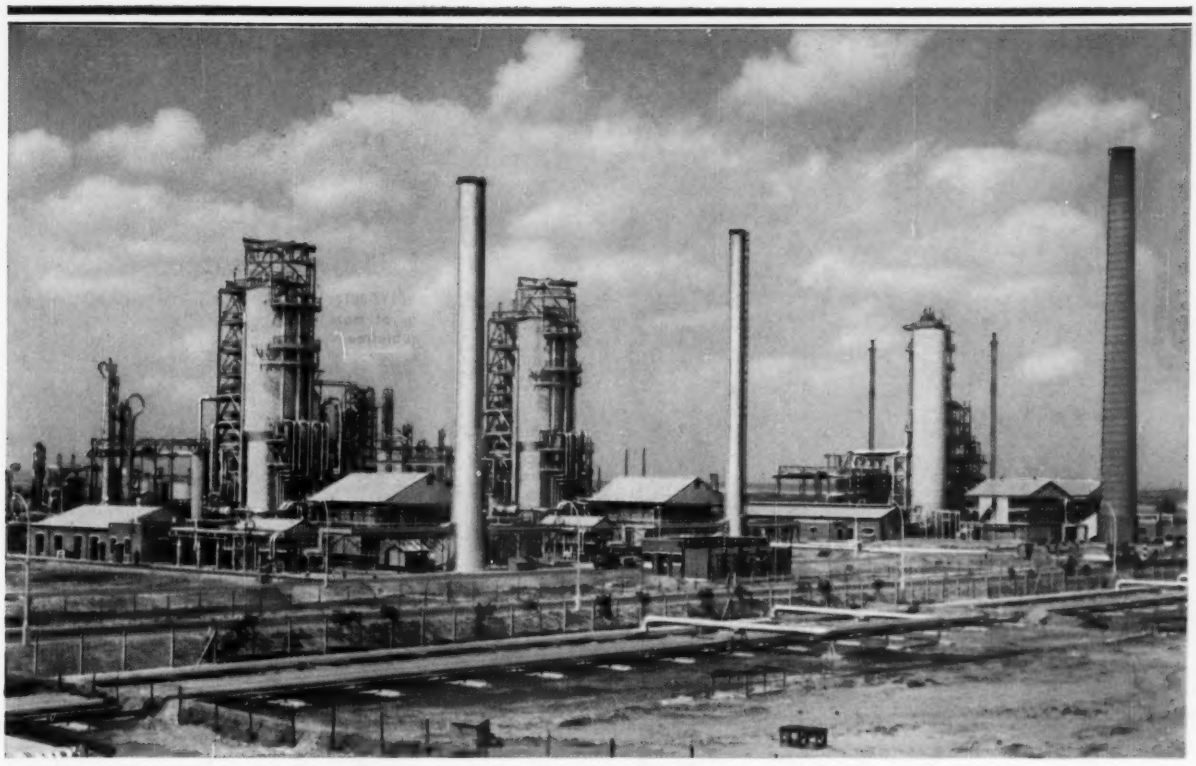
**5 NO GREASE LOSS**—Bearing housings have effective seals to prevent escape of grease.

**6 RIBBED FRAME**—Ribs on the corrosion-resistant cast iron frames add mechanical strength and increase the surface area for more efficient cooling.

**BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES**

M55-18

**ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC**



*Crude oil from the Middle East is brought to Kent in modern supertankers of 30,000-ton capacity. The Refinery, a portion of which is shown above, is designed to handle 4,000,000 tons of crude per year.*

# CRUDE OIL COMES TO KENT

The new Kent Refinery of The British Petroleum Company Limited on the Isle of Grain in the Thames Estuary below London, is a substantial addition to England's refining capacity.

The refinery, one of Europe's largest, will supply the British Isles and its export markets with high grade motor fuel, kerosene, fuel oil and lubricants.

Its products and processes were determined by The British Petroleum Company Limited who retained E. B. Badger & Sons Limited, an affiliate of Stone & Webster Engineering Corporation, for the design of certain process units and the over-all planning and erection management of the complete refinery.

***Write or call us for information as to how our experience may be of assistance to you.***

## STONE & WEBSTER ENGINEERING CORPORATION

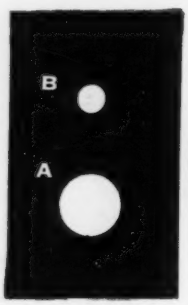
### BADGER PROCESS DIVISION

**AFFILIATED WITH E. B. BADGER & SONS LIMITED (LONDON)**

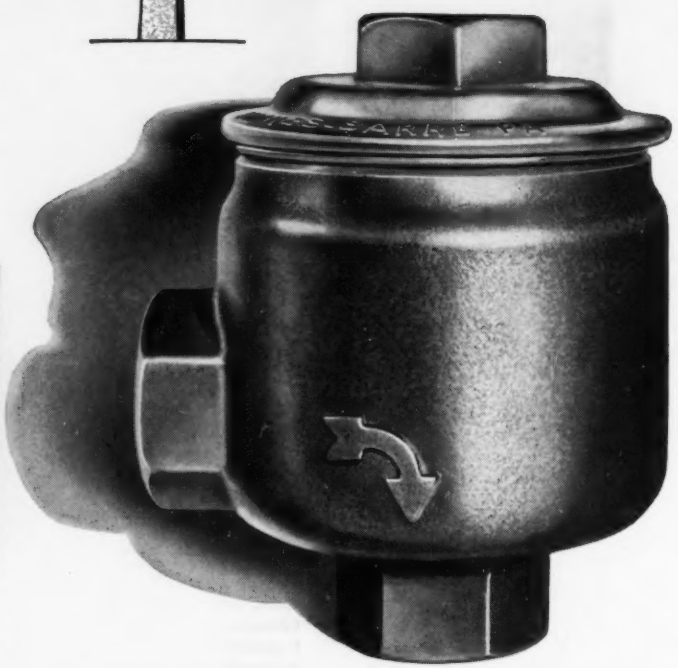
New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto

TALK ABOUT

# Capacity




Discharge orifice of 1" NICHOLSON trap (A) compared with other types of same size (B). Nicholson's greater—in every size!



Compare capacity of a Nicholson Steam Trap with any other trap of same size. Greater capacity—right across the board—means Nicholson Industrial Traps discharge condensate and air from steam lines and process equipment *faster*, more *effectively*. In toughest chemical processing service, Nicholson's pay off 4 ways:

- **lower initial cost—more for the money**
- **less upkeep expense—minor maintenance**
- **faster warmup—high, even temperatures**
- **faster production—increased 20% to 30%**

Where performance counts, specify Nicholson. Write for *Catalog 953*.

NICHOLSON

W. H. NICHOLSON and Company

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## An ester solvent with a challenging potential

# CELANESE* ETHYLENE GLYCOL DIACETATE

- S-L-O-W evaporating rate
- high boiling point
- high flash point
- colorless
- pleasant odor
- competitively priced

**for:**

Lacquers
Emulsions
Specialty Inks
Silk Screening
Baked Plastic Coatings (plasticizer)
Perfumes (fixative)
Transesterification

The services and facilities of the Celanese Technical Service and Applications Laboratories are available for your application development.

For additional information, samples, technical data, and prices, write: Dept. 553-L
Celanese Corporation of America, Chemical Division, 180 Madison Avenue, New York 16, N. Y.

### physical properties

| | |
|---|---|
| Boiling point, °C @ 760 mm | 190.5 |
| Dilution ratio with Toluene | 1.8 |
| Evaporation rate (n-butyl acetate = 1.0) | 0.02 |
| Flash point, Cleveland Open Cup, °F | 205 |
| Pounds/gallon, 68°F | 9.2 |
| Refractive index, $\frac{20^\circ C}{D}$ | 1.4150 |
| Solubility in water, % weight @ 20°C | 16.4 |
| Solubility water in, % weight @ 20°C | 7.0 |
| Specific gravity, 20°/20°C | 1.1063 |
| Vapor pressure @ 20°C mm Hg | 0.25 |
| Viscosity, centipoises @ 20°C | 2.86 |
| Viscosity, 10% 1/2 second nitrocellulose solution, centipoises @ 25°C | 444 |

### specifications

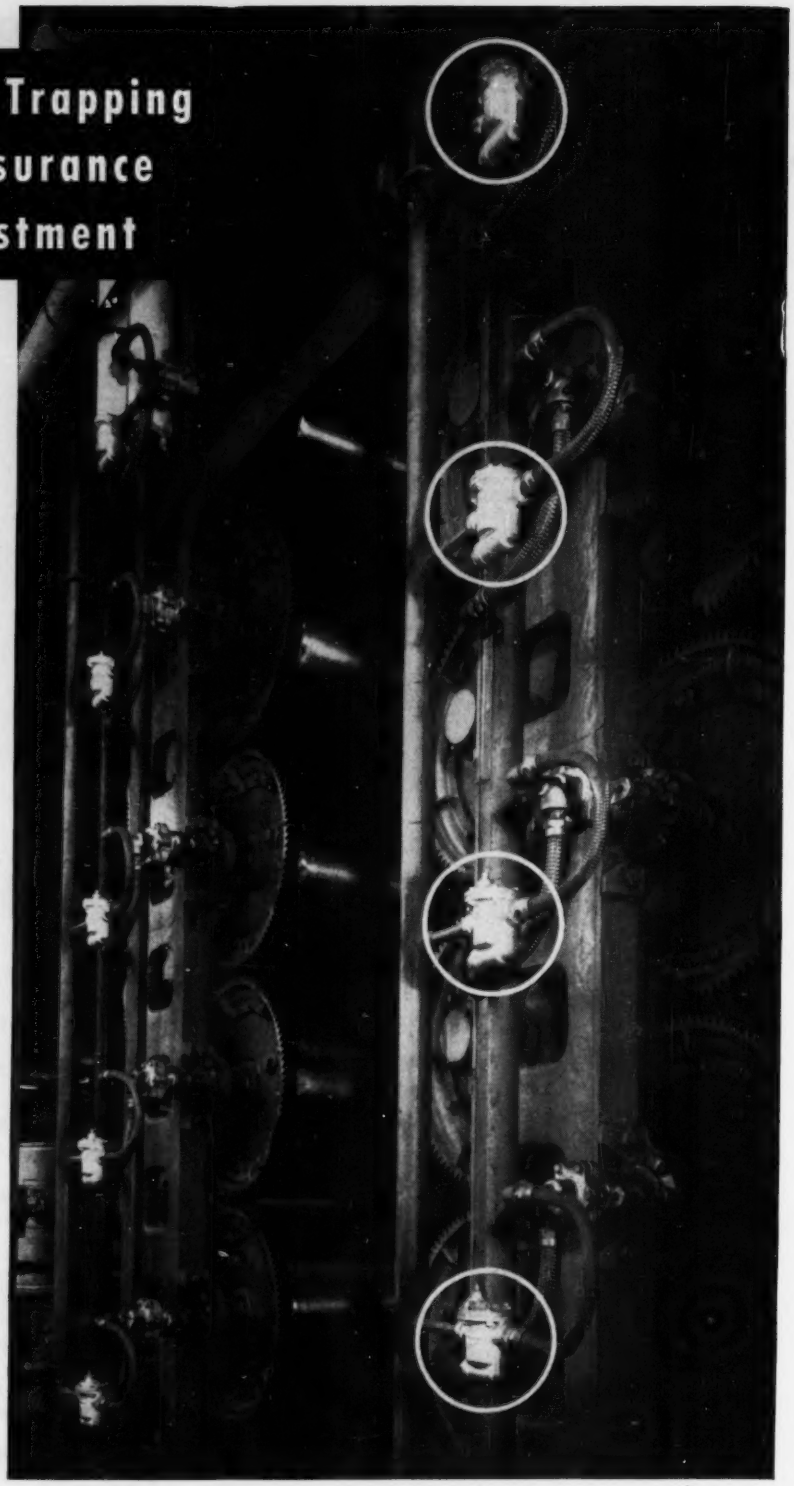
| | |
|---|---|
| Specific gravity, 20°/20°C | 1.103-1.109 |
| Distillation range, °C | 186-195 |
| Ester content, % minimum | 97 |
| Acidity, as Acetic, % weight, maximum | 0.15 |
| Color, APHA | 15 |

*Reg. U.S. Pat. Off.

Celanese* CHEMICALS

**CAREERS**...in Research, Engineering, Production and Sales.
Write Personnel Department "E" for a copy of "Celanese Careers."

# Armstrong Unit Trapping —Low Cost Insurance of a Big Investment



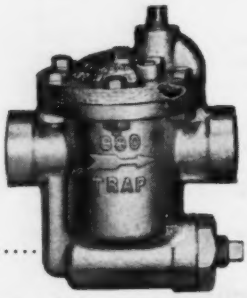
● *30% more production from kettles . . . 84 degrees higher dryer temperatures . . . 8% more output from dry kiln*—these are typical results of unit trapping with Armstrongs.

What about your plant? It doesn't make good business sense to spend $500, $5000 or $50,000 for equipment and then lose 10% to 30% or more of its productivity for lack of proper trapping.

Armstrong traps are "application engineered" by men who know trapping thoroughly—how to size traps for fast heat-up and top temperatures . . . correct installation practice . . . steam supply and return line requirements . . . variable pressure problems . . . mysterious difficulties. The cost of retrapping with Armstrongs is usually but a fraction of 1% of the cost of the equipment drained—*low cost insurance of a big investment!*

Call your Armstrong Representative today. He sells on a basis of "satisfaction or your money back." Or, write:

**ARMSTRONG MACHINE WORKS**
**85- Maple St., Three Rivers, Mich.**




**Armstrong built-in strainer traps, pictured on textile dry cans at the right, cost less to buy and install than standard traps and separate strainers—they reduce maintenance and costly shutdowns. Three sizes, ½" or ¾" connections.**

**SEND FOR FREE STEAM TRAP BOOK . . .**

**. . . 44 pages of how-to-do-it data. Useful and educational. Free on request without obligation.**

S45

# ARMSTRONG STEAM TRAPS

Developments in Color Measurement

***GENERAL ANILINE COLORIST SAYS . . . .***

# "G-E Spectrophotometers Are Invaluable for Production-line Color Analysis"

"Even the most complicated color-matching problems are taken in stride by General Electric's recording spectrophotometers," says Irving W. Feyler, Colorist at General Aniline & Film Corporation, Rensselaer, New York.

Rapid production-line analysis of dyes by G-E spectrophotometers help General Aniline technicians maintain constant color control. A complete spectrophotometric curve of the most complex dyestuffs can be drawn in only 54 seconds.

**MATERIAL SAVINGS** are assured because costly mismatching of dyes for textile, plastic, paint, ink, paper, and other products is practically eliminated.

Versatile and accurate, the G-E spectrophotometer has a range of 380 to 700 millimicrons.* The instrument will measure both transparent and opaque samplings.

Additional savings are made by using the automatic tristimulus integrator. Provided as an accessory to the spectrophotometer, the integrator automatically calculates numerical color values at the completion of the spectrophotometric curve.

**FOR MORE INFORMATION,** contact your nearest G-E Apparatus Sales Office, or write for bulletin GEC-307 to General Electric, Section 585-18, Schenectady 5, N. Y.

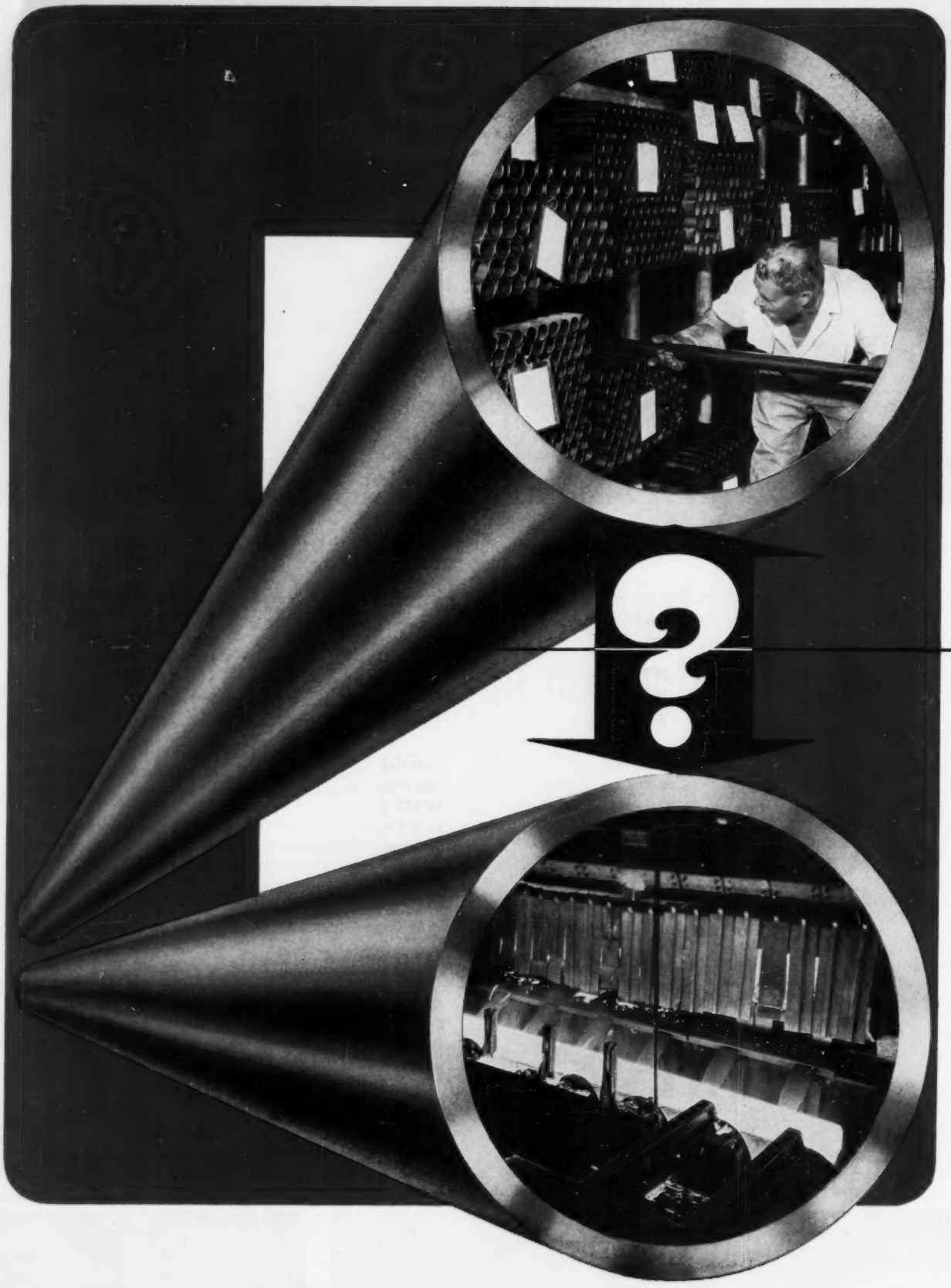
*Special ranges can also be provided.

## GENERAL ELECTRIC

**1. INSERTING SAMPLE** and standard color specimens into G-E spectrophotometer, operator prepares to run test.

**2. SELECTING RECORDING SPEED** is next step. Color measurement is automatically recorded by G-E instrument.

**3. ANALYSIS AND COMPARISON** of test and standard curves is final step in accurate production-line color control.



# tubing selection:

# SIZE

**In choosing tubular material for specific applications, the question of size, if not thoroughly studied, can be costly both in time and money. Often, the tendency in selecting size is to stick to original design which may appear, at first, to be the most economical but which really is more costly.**

For instance, the design of a heat exchanger indicated the following 18-8-Ti (TP321) tubing was needed for various connections:

**1 piece 6¾" OD x .250"w x 20' 6"**
**1 piece 3¼" OD x .250"w x 8' 2"**
**1 piece 2½" OD x .300"w x 5' 3"**

As these were odd sizes, not available in stock, it would have been necessary to manufacture the material which at the time would have required eight to ten weeks for delivery. Since it would have been necessary to manufacture the material, minimum mill quantities were involved. This meant that a minimum of two billets for each size would be processed into tubing and the purchaser would be required to take the product of these. Because of the rather short lengths of the last two items, there was a possibility that the purchaser would have been responsible for two pieces of the first item, four pieces of the second item and eight pieces of the third—and at a total cost to him, because of the excess material, of approximately four times what he had estimated.

By converting to pipe sizes such as: 6" Schedule 40S (6⅝" OD x .280"w), 3" Schedule 80S (3½" OD x .300"w) and 2" Schedule 160 (2⅜" OD x .343"w), it would have been possible not only to maintain the original working pressures involved, but to eliminate practically all of the excess material, thus bringing material costs in line. In this particular case, the solution was even better—the original plans involved the use of TP321 (Croloy 18-8Ti) but an alternate material Croloy 18-8 Cb Ta was offered as a possibility. Base cost of the latter was about 12% higher than former, but the 18-8 Cb Ta material was available from stock and in the exact lengths required. The manufacturer was able to save six to eight weeks in time and through the elimination of the excess material quite a respectable amount of money.

Tubing selection requires expert judgment and experience—and there is no substitute for the kind of experience that you will find at B&W. To get the most benefit from B&W's long experience in matching tubes to jobs in every respect, call on Mr. Tubes, your nearby B&W Tube representative. He has helped others, as he can help you, make tubing selection *surer*.

**THE BABCOCK & WILCOX COMPANY**
***TUBULAR PRODUCTS DIVISION***
***General Offices:* Beaver Falls, Pennsylvania**
***Plants and Products***
**Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing**
**Alliance, Ohio—Welded Carbon Steel Tubing**
**Milwaukee, Wis.—Seamless Tubing; Welded Stainless Steel Tubing; Seamless Welding Fittings**

**TA-5054P**

# Choose a LINK-BELT Vibrating Screen for your screening job

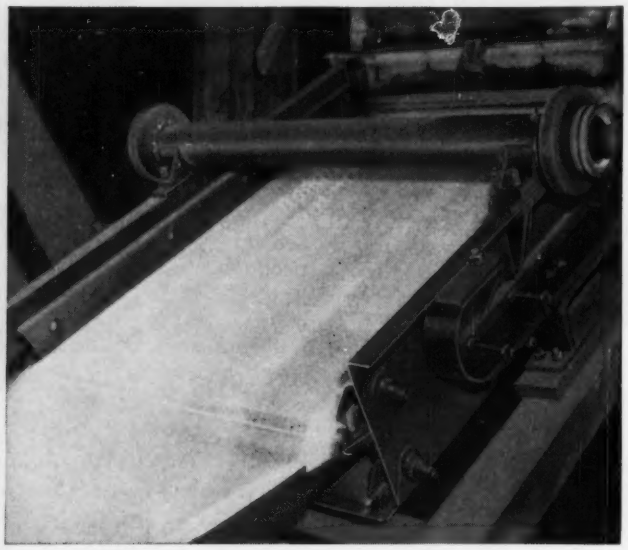
## Sizing, Scalping, Dewatering, Rinsing . . . at LOW COST

Link-Belt "CA" Vibrating Screen and non-clogging spray nozzles are combined for efficient washing and sizing.

**CA**

**For high-capacity screening of a broad range of materials**—Link-Belt "CA" Vibrating Screens are your answer. Concentric Action of vibrator mechanism imparts positive, uniform, circular motion to every square inch of the screening surface. Centrifugally-actuated, unbalanced weights reduce vibration of accelerating and decelerating—are easily adjusted to the amplitude of highest screening efficiency. What's more, lively vibrating action achieves bed stratification *fast*—assures accurate sizing, thorough rinsing, rapid dewatering. Made in a complete range of sizes to suit all plant capacity requirements—single, double or triple decked.

Call your nearest Link-Belt office or write for new Book 2554.



Here fine silica sand is effectively sized by a double-deck Link-Belt "UP" Unbalanced Pulley type vibrating screen.

**UP**

**For economical separation of light to medium weight materials**—choose Link-Belt "UP" Vibrating Screens. Positive, high-frequency action over entire area of cloth provides maximum sizing opportunity for every particle. Even on the smallest cloth sizes, blinding is virtually eliminated. And you'll like the lower power and maintenance costs resulting from two-bearing simplicity. "UP" screens are available in open, semi-enclosed, or totally-enclosed types, single or multiple decks in a wide range of sizes.

*Get complete information at your nearest Link-Belt office or by writing for Book 2377.*

# LINK-BELT

THE SYMBOL OF QUALITY — LB — LINK-BELT

**VIBRATING SCREENS**

**LINK-BELT COMPANY:** Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13,817

*Why be satisfied with standard, off-the-shelf columns?*

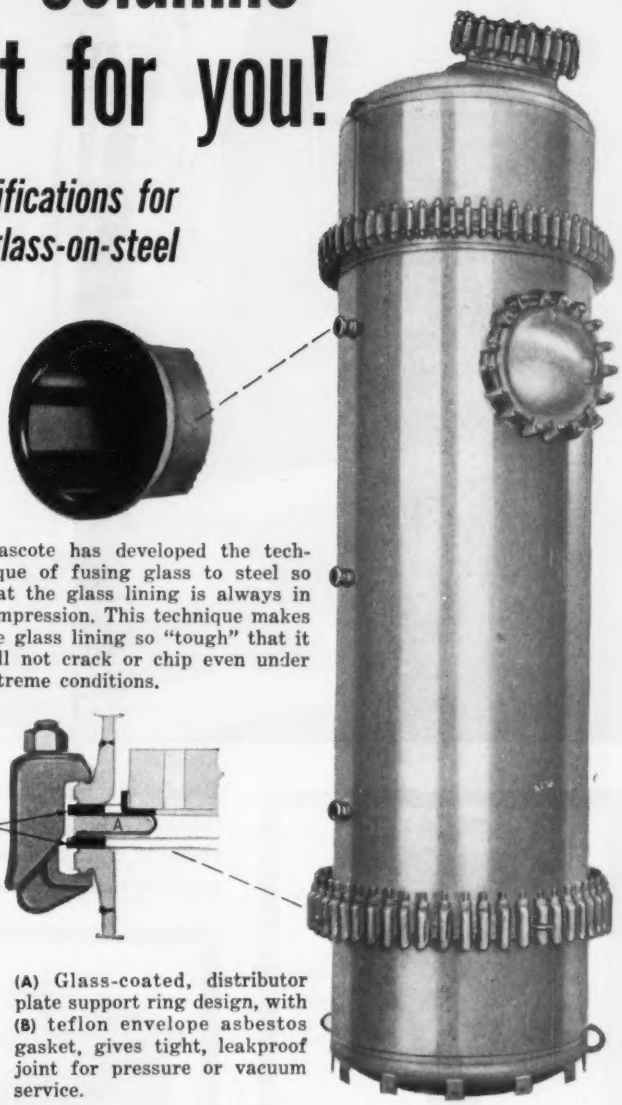
# Specify Glascote Columns custom-built just for you!

***We can meet your performance specifications for packed columns of any size... with glass-on-steel or alloy... custom-built or standard***

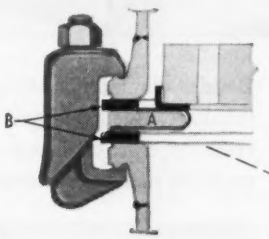
IF you're faced with surface catalysis, catalyst poisoning or product contamination, our custom-built, glass-lined columns are the answer to your problems. Units designed for distillation, extraction, alkylation, absorption, adsorption and other process operations . . . with jacketing if required. These glass-lined, corrosion-resistant columns are made in a full range of sizes . . . of any desired diameter and length to assure maximum process efficiency and long life.

What's more, Glascote's engineers will assist you in analyzing your process operations . . . recommend the type and size of column best suited to your process. Call Glascote today! Be sure when you buy that you're getting the best in processing equipment.

**Our standard one year guarantee continues to apply to all Glascote glass-lined products.**



Glascote has developed the technique of fusing glass to steel so that the glass lining is always in compression. This technique makes the glass lining so "tough" that it will not crack or chip even under extreme conditions.




(A) Glass-coated, distributor plate support ring design, with (B) teflon envelope asbestos gasket, gives tight, leakproof joint for pressure or vacuum service.

**Glascote®**
PRODUCTS, INC.

Sales offices or agents located in
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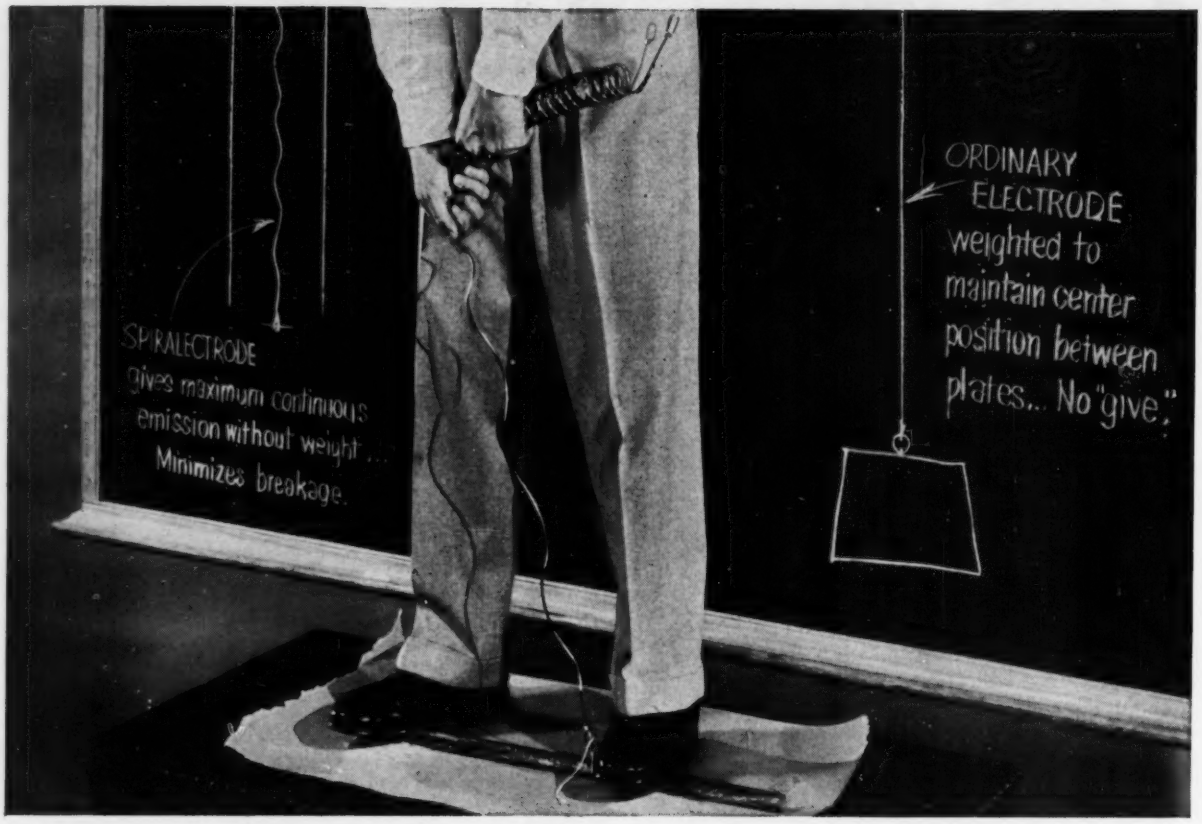
Dayton • Houston • Los Angeles • Toronto • Montreal
Export Sales: A.O. Smith Corp., International Division, Milwaukee 1, Wis.

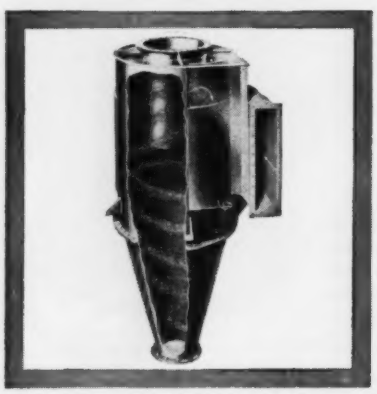
**Ask the representative who calls on you for all the facts about Glascote products — reactors, receivers, condensers, evaporators, storage tanks and accessory products. Or, if you prefer, write direct. Glascote Products, Inc., Cleveland 17, a subsidiary of A. O. Smith Corporation.**

## A subsidiary of A.O.Smith Corporation

**World's largest manufacturer of glass-lined steel products**

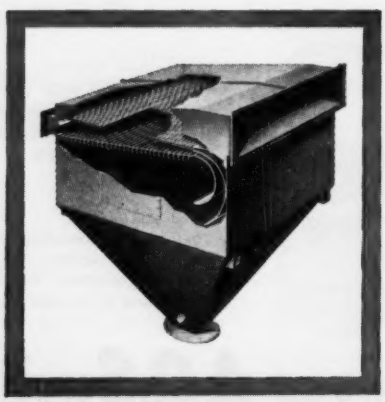
# Electrode Breakage is no problem in Buell "SF" Electric Precipitators


SPIRALECTRODE
gives maximum continuous emission without weight... Minimizes breakage.
ORDINARY ELECTRODE
weighted to maintain center position between plates... No "give."

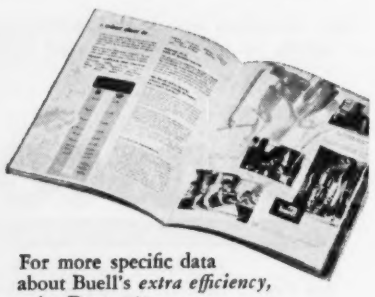


Buell Cyclones offer two "extra-efficiency" advantages: (1) exclusive shave-off which harnesses double-eddy and puts it to work, and (2), large diameter design which eliminates clogging.

**Besides eliminating efficiency drops and "shutdowns" due to electrode breakage, Buell's unique Spiralectrode permits higher and more constant emission, extra efficiency. Also, Continuous Cycle Rapping—another Buell exclusive—keeps electrodes constantly clean for maximum performance!**



**Buell's Low Resistance Fly Ash Collector combines top efficiency with low draft loss, for natural or forced draft installations. Ideal for boilers from 100 to 2000 BHP.**



For more specific data about Buell's *extra efficiency*, write Dept. 121, Buell Engineering Company, 70 Pine Street, New York 5, N. Y

buell®

MECHANICAL ELECTRICAL *Experts at delivering Extra Efficiency in* **DUST COLLECTION SYSTEMS**

# . . . he offers you world wide knowledge of water

Under the hat worn by "the man from Layne" is the experience gained in developing water resources of the world for nearly three quarters of a century.

This knowledge is yours without cost or obligation. And experienced men know that on any question from exploration through well drilling to installation, as well as maintenance and modernization, to "ask the man from Layne" is to get unbiased factual information on any phase of water supply for industry, municipalities or agriculture.

**LAYNE & BOWLER, INC.**
*General Offices*
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**water wells • vertical turbine pumps • water treatment**

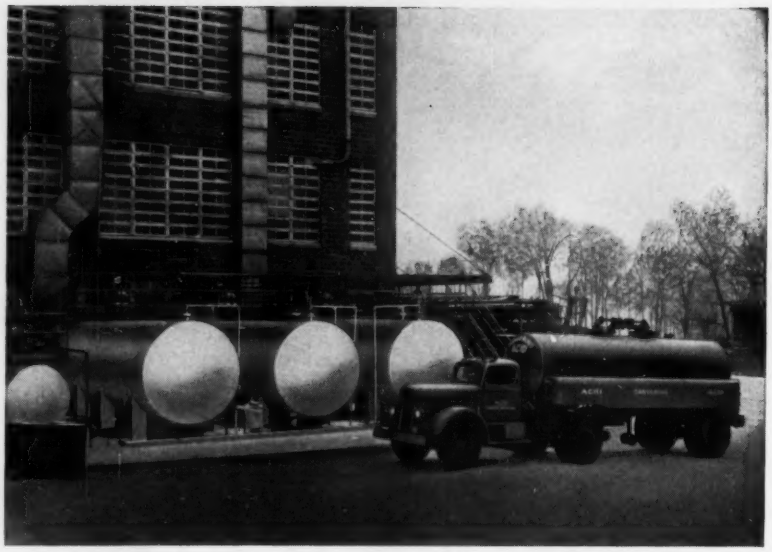
# HOW TO BUY RUBBER LININGS

## FOR PERMANENT PROTECTION AGAINST CONTAMINATION AND CORROSION

Insist on a tank lining job that assures an inseparable bond of rubber to metal. Get rubber lining that is applied by a company with complete facilities to handle any type of equipment, even the largest and most complex.

Wherever corrosive acids, salt solutions and other chemicals are constantly handled, your equipment needs the kind of protection possible only with specially compounded acid-proof rubber linings. Linings of thick, non-porous layers of rubber, rather than a mere film or coating, offer the lasting protection that lengthens the service life of your processing equipment. Make certain the rubber lining on your equipment is compounded to withstand changes in temperature . . . to resist abrasion, cracking and damage by corrosion. Where rubber lining presents a resilient, non-breakable surface bonded to the metal so securely it can't be separated, you can be sure your equipment has *permanent* protection against corrosion . . . your process solutions *positive* protection against contamination.

Entrust your lining job to the company with a long standing reputation for leadership in rubber lining techniques and facilities...specify Rubber Lining by Manhattan.



Manhattan Rubber-Lined tanks with interconnecting rubber-lined pipe used in muriatic acid storage. Each tank has own pumping system. Truck tank with its piping also rubber-lined.

## MANHATTAN RUBBER LININGS

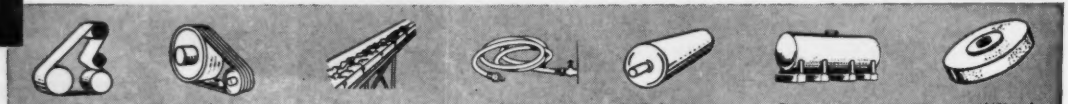
You get permanent, positive protection against losses from equipment corrosion and process contamination with Manhattan Rubber Linings. They are made from thick, calendered sheets of natural or synthetic rubber inseparably bonded to the metal by an exclusive Manhattan process for maximum durability. Manhattan Rubber Linings resist acids and alkalies . . . they expand and contract with the metal under extremes of temperature and will not harden, crack or break under normal conditions of use. Every Manhattan Lined tank is tested under high voltage to make certain the protection of your equipment and processes is flawless and permanent. Because Manhattan has the most modern and complete lining facilities available today, they can handle your job regardless of its size or complexity. Contact the R/M representative at the Manhattan Rubber Lining plant nearest you.

RM 522

**RUBBER LINING PLANTS AT PASSAIC, N.J. and NORTH CHARLESTON, S.C.**

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

**RAYBESTOS-MANHATTAN, INC.**

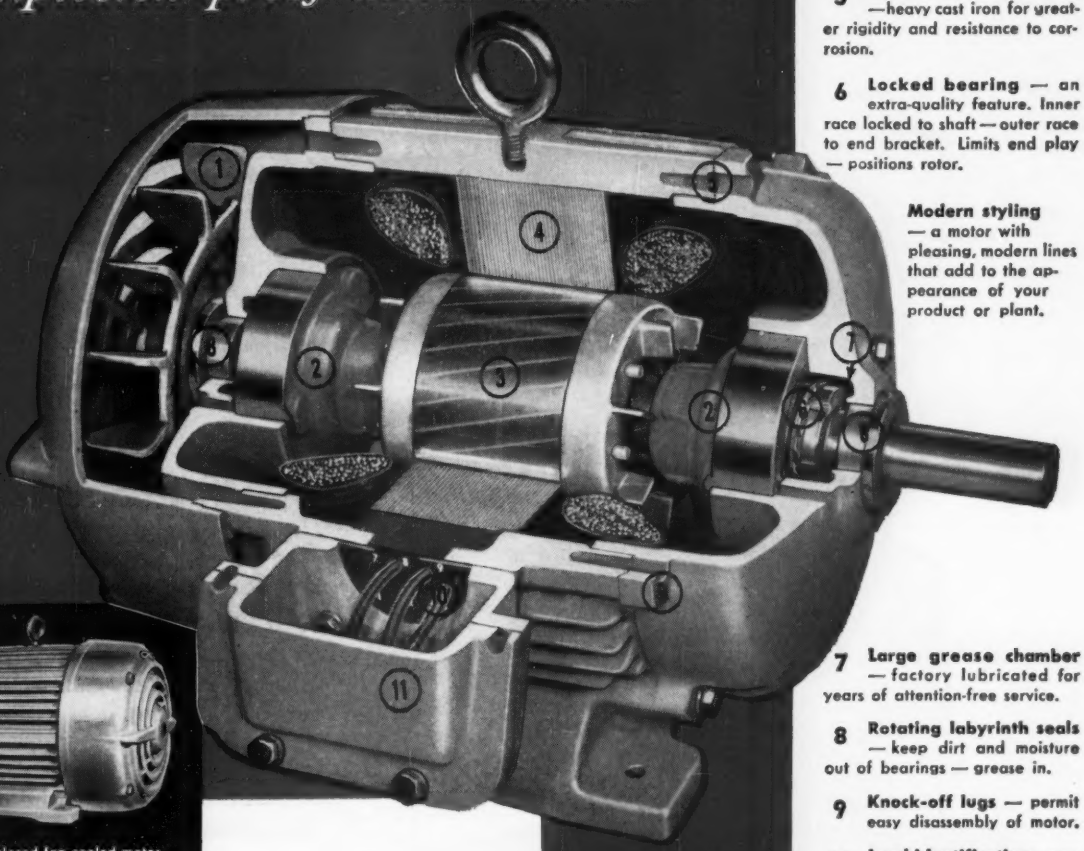



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Bowling Balls

*Here's the inside story of*

# *the* NEW L.A. *Line*

## *...your BEST enclosed and explosion-proof motor BUY*



**1 Fan** — efficient, non-sparking fan. New aerodynamic design for more effective cooling.

**2 Inner bearing cartridges** — lock bearings to end bracket and form explosion-quenching seal along shaft.

**3 Indestructable cast-aluminum rotor**—dynamically balanced with fan for smooth, quiet operation.

**4 Stator** — prewound stator core utilizes Formvar wire insulated with a new Alkyd Asphalt Resin insulating varnish.

**5 End bracket and housing** —heavy cast iron for greater rigidity and resistance to corrosion.

**6 Locked bearing** — an extra-quality feature. Inner race locked to shaft — outer race to end bracket. Limits end play — positions rotor.

**Modern styling** — a motor with pleasing, modern lines that add to the appearance of your product or plant.

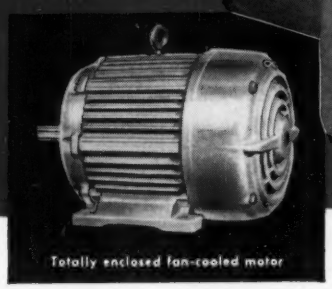
**7 Large grease chamber** — factory lubricated for years of attention-free service.

**8 Rotating labyrinth seals** — keep dirt and moisture out of bearings — grease in.

**9 Knock-off lugs** — permit easy disassembly of motor.

**10 Lead identification**—permanent, positive lead identification spacer in conduit box.

**11 New split conduit box** — rugged cast-iron conduit box diagonally split for easy connection.



Totally enclosed fan-cooled motor

Cutaway view of explosion-proof motor

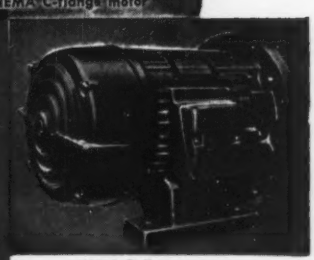
This is the completely new L.A. totally enclosed fan-cooled and explosion-proof motor. Every feature in this new line is designed for easier installation, longer service life, less maintenance and attention. You get the full benefit of the new NEMA standards in a smaller, more functional, completely modern design.

Your nearby Louis Allis Sales Engineer can show you all the reasons why these motors perform better and longer on your tough jobs — why they give you maximum resistance to corrosion wherever you need this extra protection. Call him today.

**THE LOUIS ALLIS CO.**
**MILWAUKEE 7, WISCONSIN**

Vertical NEMA D-flange motor

NEMA C-flange motor



NEMA D-flange motor

*We specialize in* SPECIAL MOTORS — *and* PROMPT DELIVERY, TOO

There's a Louis Allis special motor for your toughest application. Whatever electrical or mechanical modifications you need, check first with Louis Allis.

# One Answer

## ...for EVERY Small Forged Steel Gate Valve Application

## Chapman List 960

If you want a small gate valve to control pressures from 380 pounds at 1000°F to 2000 pounds at 100°F . . . if you want low cost operation under the most grueling of conditions . . . if you want top valve performance . . . specify Chapman List 960. It's the forged steel gate valve that's the popular choice for a wider variety of applications than any other comparable valve on the market today.

*Here's the reason why:*

**Chapman List 960 is tough**

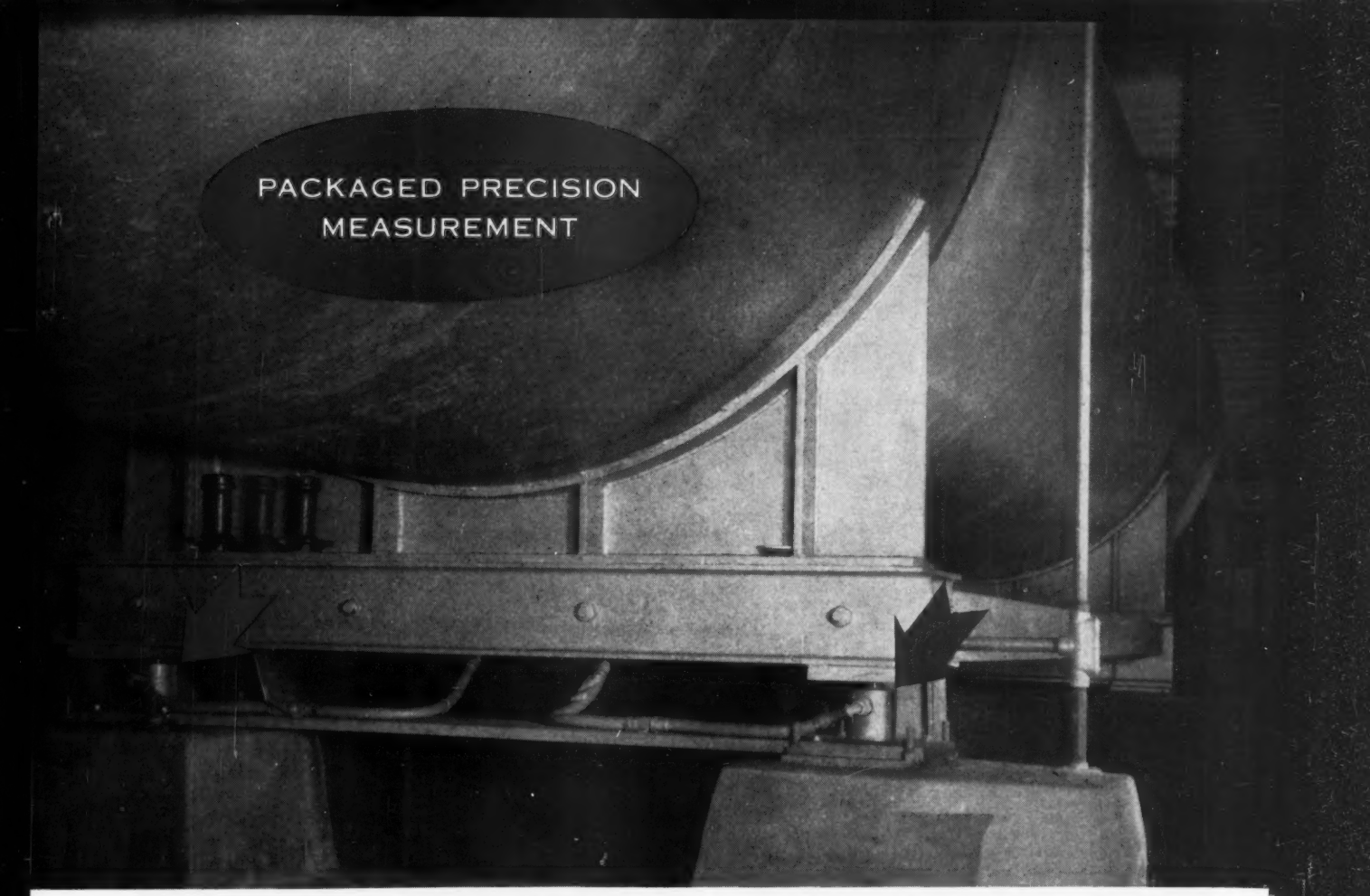
It has wedge faces hardened to 800 Brinell by the exclusive Malcomizing process to prevent seizing or galling. Replaceable hardened stainless steel seat rings assure tight closing and smooth operation. Snug seating permits full pressure repacking. Extra strong stem and gate connections take unusual stresses.

**Chapman List 960 is versatile**

It's available in all standard sizes from ¼" to 2" with screw or welding ends, and in two types, rising stem with yolk and rising stem with inside screw. Made in various alloys and combinations of alloys, the Chapman List 960 guarantees reliable performance over an unusually wide range of applications.

Whatever your needs for small forged steel gate valves the Chapman List 960 can do the job better and at lower operating cost. For higher pressures specify Chapman List 990. Write today for Catalog 10 and get full details.

**The CHAPMAN Valve Manufacturing Company**
INDIAN ORCHARD, MASSACHUSETTS




Stanley Home Products, Inc. checks Freon losses as

# Two tiny SR-4® Load Cells weigh 200,000 lb. tanks automatically

Baldwin's "Packaged Precision Measurement," neatly solved the handling of large volumes of Freon at the Stanley Home Products plant in Easthampton, Mass. A constant record of stored and used quantities was needed to avoid excessive leakage and evaporation losses.

Continuous automatic weighing of their two 15,000 gallon storage tanks with Baldwin SR-4 Load Cells answered Stanley's problem perfectly. Two small SR-4 compression-type 50,000 lb. load cells were installed as supporting members on the concrete base at one end of each tank. These support exactly half the load of the 200,000 lb. tanks and the instruments are calibrated to read only the weight of the Freon in the storage tanks.

Reinforced flexible hose at inlet and outlet eliminates effect of connecting piping on weighing accuracy.

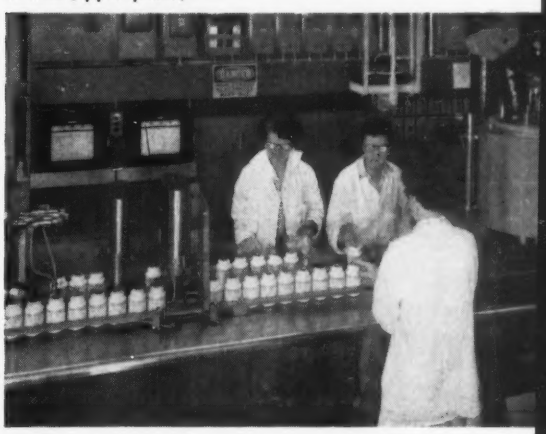
This Baldwin system gives Stanley weighing accuracy within ½ of 1% of scale (200,000 lbs.). Baldwin-engineered instrumentation provides remote indicators at the tank car siding and recorders at a centralized control panel. The weighing system controls a motor-driven pump at the siding, shutting it down automatically when the tanks have 13,500 gallons of Freon.

*Packaged Precision Measurement* can solve similar problems for *you*. For detailed information on SR-4 Device applications and instrumentation use coupon today.

**Eddystone Division**

**BALDWIN - LIMA - HAMILTON**

Baldwin strip chart recorders on wall (lower photo) show rate of consumption of Freon. Recorders are connected by electrical cables to SR-4 Load Cells under one end of 15,000 gallon tanks on other side of wall (upper photo).



Dept. 3304
Baldwin-Lima-Hamilton Corp.
Philadelphia 42, Pa.
(In Canada: Peacock Bros., Ltd., Montreal, Quebec)

Please send me the following new literature

- ☐ Bulletin 4300 (Introduction to SR-4 Devices)
- ☐ Bulletin 4301 (SR-4 Load Cells and Load Beams)
- ☐ Bulletin 4302 (SR-4 weighing of tanks, bins, hoppers)
- ☐ Bulletin 4306 (SR-4 Fluid Pressure Cells)

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Exploring the operating advantages of Goulds Fig. 3715 chemical pump.

# Take this pump apart right in your office . . . and you'll see how it can *save* you *money*

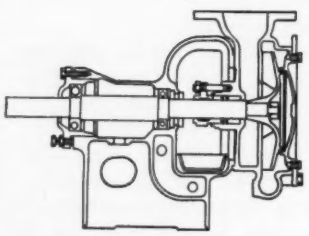
You'll find new features in the Goulds Fig. 3715 chemical pump.

They're features that make it a rugged, dependable, long-lived pump for handling corrosive liquids. And you can check them yourself without moving away from your desk.

We've built an aluminum model of the Fig. 3715 pump — complete in every detail. Ask your Goulds representative to show it to you.

You can open it up, take it apart, and see in detail such features as the easy method for adjusting impeller clearance—the chamber for cooling the support head so that you can operate the pump up to 350° F.—the design that permits you to inspect and clean the inside of the pump without disturbing the piping.

Call your Goulds representative today. Tell him you'd like to examine the Fig. 3715 model and he will gladly set a date at your convenience. Or write us in Seneca Falls and we'll make the arrangements promptly.



CROSS SECTION of Fig. 3715 pump.

You can get the Goulds Fig. 3715 pump in an alloy to meet your liquid handling requirements, including 316 and Gould-A-Loy 20 stainless steels, all iron, all bronze, bronze-fitted,—iron with stainless trim, or bronze with stainless trim. And it's available in 9 sizes providing capacities up to 720 GPM, and heads up to 200 ft. For additional details write for Bulletin 725.4.

MEMBER HYDRAULIC INSTITUTE

Goulds PUMPS INC. Seneca Falls New York

Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburg • Tulsa

# NEED EXTREME DRYNESS?

# ALCOA Activated Alumina dries to lower dew points than other commercial adsorbents

**TYPICAL PROPERTIES OF DESICCANT GRADES ALCOA ACTIVATED ALUMINAS**

| CHEMICAL ANALYSIS, % | F-1 | F-3 | F-5 | F-6 | H-151 |
|---|---|---|---|---|---|
| $Al_2O_3$ | 92 | 92 | 77 | 88 | 85 |
| $Na_2O$ | 0.80 | 0.80 | 0.70 | 0.76 | 2.0 |
| $Fe_2O_3$ | 0.12 | 0.12 | 0.10 | 0.11 | 0.15 |
| $SiO_2$ | 0.09 | 0.09 | 0.08 | 0.08 | 6.3 |
| Loss on Ignition 1100°C (2012°F) | 6.8 | 7.2 | 12.4 | 8.5 | 6.2 |
| $CaCl_2$ | ..... | ..... | 9.3 | ..... | ..... |
| $CoCl_2$ | ..... | ..... | ..... | 2.0 | ..... |
| **PHYSICAL PROPERTIES** | | | | | |
| Form | Granular | Granular | Granular | Granular | Ball |
| Surface Area, meters²/g | 210 | 200 | ..... | 200 | 350 |
| Bulk Density, Packed, lb/ft³ | 55 | 55 | 60 | 57 | 55 |
| Bulk Density, Loose, lb/ft³ | 50 | 50 | 55 | 52 | 52 |
| Specific Gravity | 3.3 | 3.3 | ..... | ..... | 3.1-3.3 |
| Dynamic Sorption* | 13-15 | 11-13 | 18-23 | 13-15 | 21-23 |
| Crushing Strength† | 55 | 55 | ..... | ..... | 60 |
| Pore Volume, ml./g | 0.25 | 0.25 | ..... | 0.25 | 0.3 |
| Pore Diameter, Å | 40 | 40 | ..... | 40 | 50 |
| Static Adsorption at 60% Relative Humidity, % | 13.0 (Min.) | 11.0 (Min.) | ..... | ..... | 20.0 (Min.) |

The standard sizes for F grade alumina are ½" to ¼", ¼" to 8 mesh and 8 to 14 mesh. Other nonstandard sizes from 2" granules to 325 mesh powder are available. Activated Alumina H-151 is available in nominal ⅛" and ¼" diameter balls.

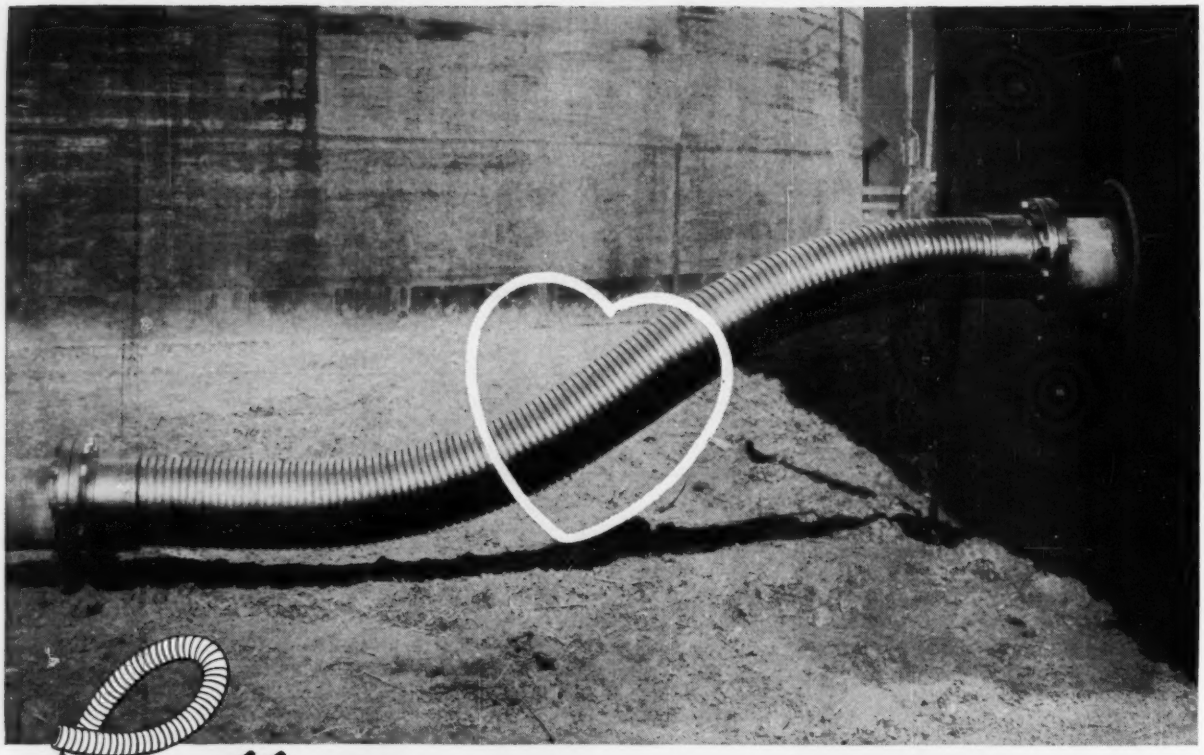
*Adsorption of moisture at 100% efficiency from air under isothermal conditions at 30°C and 84% relative humidity under dynamic flow of 7.5 cu ft/hr/lb *Activated Alumina—Its Properties and Uses.*
†Method of *Activated Alumina—Its Properties and Uses.*

ALCOA® Activated Aluminas are among the most effective and efficient desiccants available for the dehydration of liquids and gases. Dew points as low as minus 100°F—and even lower—may be obtained, and under normal circumstances, ALCOA Activated Aluminas can be used for an almost indefinite number of drying cycles.

Besides their use for dehydration, ALCOA Activated Aluminas adsorb certain gases and vapors from gaseous mixtures and serve as catalysts and catalyst carriers. They are used in the liquefaction of gases, and for the maintenance of transformer and lubricating oils.

Let us tell you more about these efficient desiccants, and supply you with samples. Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 702-M Alcoa Building, Pittsburgh 19, Pa.

ALCOA CHEMICALS
ALUMINUM COMPANY OF AMERICA



# Penflex PUTS SAFETY IN MOTION

***Leakproof tubing reduces fire hazard in moving flammable liquids***

● A seepage of the combustible materials being pumped from one tank to another . . . plus an unaccounted-for spark . . . adds up to an unpredictable fire loss to buildings, tanks and equipment.

Penflex special packed 4-wall interlocked tubing equals rigid pipe in preventing such leakage . . . exceeds it in breakage resistance because its flexibility absorbs the strains caused by settling of tank foundations or the expansion and contraction from ambient temperature changes.

An interconnection between storage tanks is but one of hundreds of applications for Penflex applications in the oil and gas industry. Use it for intake and exhaust lines on Diesel engines and compressors . . . for transferring heavy viscous materials, like the tar and asphalt used in painting and wrapping pipe lines . . . sealing all types of pipe joint assemblies . . . moving petroleum products for sea or rail transportation.

In the Penflex booklet describing "Flexineering"—the science of using the correct tubing for a particular job—are dozens of other suggested uses, also complete descriptions of Penflex corrugated, or Penflex four-wall interlocked flexible tubing. Send for your copy today.

**Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Philadelphia 42, Penna. • *Branch Sales Offices:* Boston New York • Chicago • Houston • Cleveland and Distributors in Principal Cities**

*flexineering by*

**PENFLEX**

**HEART OF INDUSTRY'S LIFELINES**

**FLEXIBLE TUBING, AUTOMATIC BARREL FILLERS, PNEUMATIC RIVET PASSERS, ACCESSORIES AND FITTINGS**

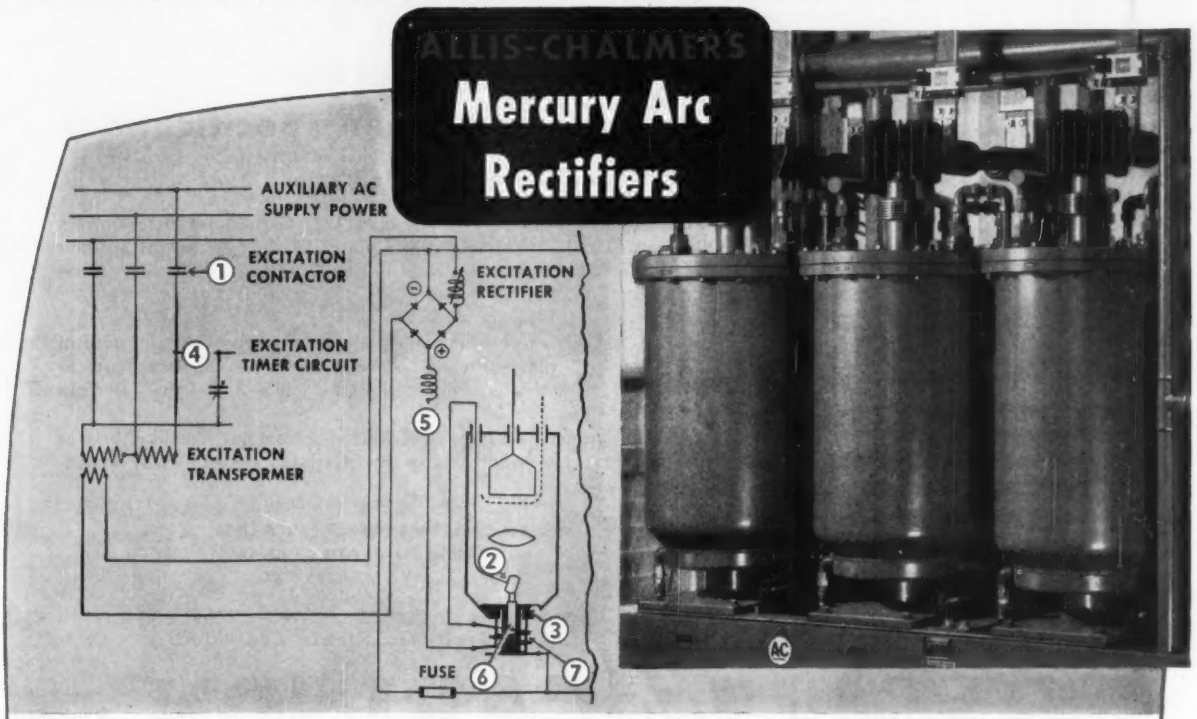
## For Reliable Rectifier Operation Get

# Continuous Excitation

Allis-Chalmers excitron rectifiers eliminate the need for a pulse-type firing system timed for operation every cycle. Maintenance is easy because of the simplicity of design.

A small dc excitation arc is automatically ignited only once, when the unit is started, and then maintained on the mercury cathode of each rectifier tube. It offers advantages similar to a pilot light. Since it is far easier to maintain an arc than to start it, this feature makes the excitron far less likely to lose excitation during power supply disturbances than other types of rectifiers.

Get all the facts about excitron rectifiers before your next installation. Call the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.




### Supply of DC Provides Key to Continuous Excitation

Direct current supplied from excitation rectifiers is the key to continuous excitation. When the excitation system is energized by means of a contactor (1), positive dc potential appears on the excitation anode (2) of each tube, negative at the cathode (3). A timer (4), through contacts of the excitation failure relay (5), is energized at the same time.

As soon as voltage is applied, current flows from the anode to the cathode through the ignition plunger (6). This current energizes the ignition coil (7) and causes the plunger to be pulled below the mercury surface. As the plunger travels down, an arc is drawn which transfers from the graphite tip of the plunger to the mercury. This current flow keeps the coil energized, maintaining a continuous arc.

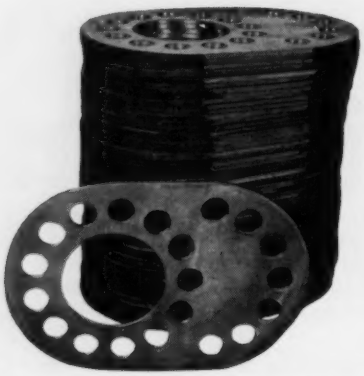
If excitation failure should occur while the rectifier is carrying load, the plunger is released, floating upward in the mercury until it makes contact with the anode, then repeating the process above until the arc is re-established.

Re-establishment of the arc as outlined takes less than a second — it does not interfere with normal operation.

**ALLIS-CHALMERS**

A-C ALLIS-CHALMERS

A-4592



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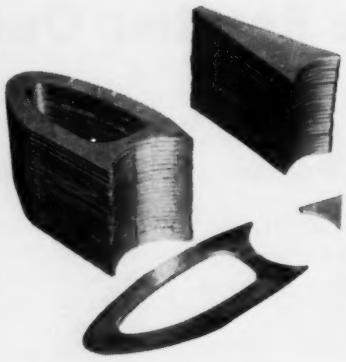

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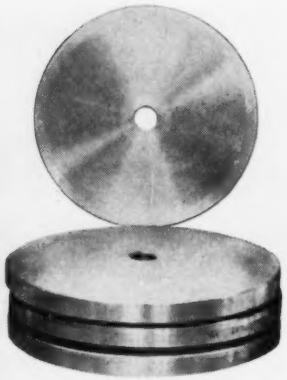
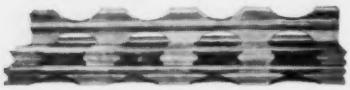
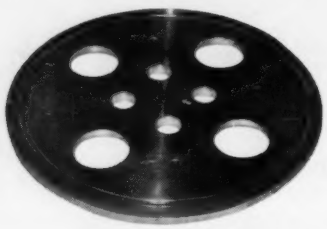


Blank size: 5" thick x 78" OD

Blank size: 4" thick x 7¾" x 71⅜".
Illustrations show before and after machining.



**All the products illustrated here were flame cut, sawed, abrasive cut, sheared or machined from stainless steel plate.**



Blank size: 2" thick x 60" OD

## Stainless steel plate produced to your specifications for quick delivery

Confidence in Carlson service has made G. O. Carlson, Inc. the country's leading specialist in stainless steel plate. As we grew to this position in the industry, we learned and developed new methods of working stainless plate.

What does this mean to you?

It means you can buy for quick delivery exactly what you need in stainless steel plate—sheared, sawed, flame cut, abrasive cut, or machined. And this is true whether the job is a "toughy" or "run of the mill"!

When you need stainless steel plates—special patterns like these or plain rectangles—you'd better try Carlson service, where experience pays off.

**write for CARLSON'S WEEKLY STOCK LISTS . . .**
**YOUR GUIDE TO WHAT'S AVAILABLE**
**IN QUALITY STAINLESS STEEL**

***Stainless Steels Exclusively***

**G. O. CARLSON, INC.**

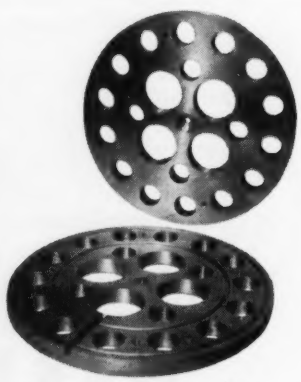
**THORNDALE, PENNSYLVANIA**

**Plates • Plate Products • Forgings • Bars • Sheets (No. 1 Finish)**

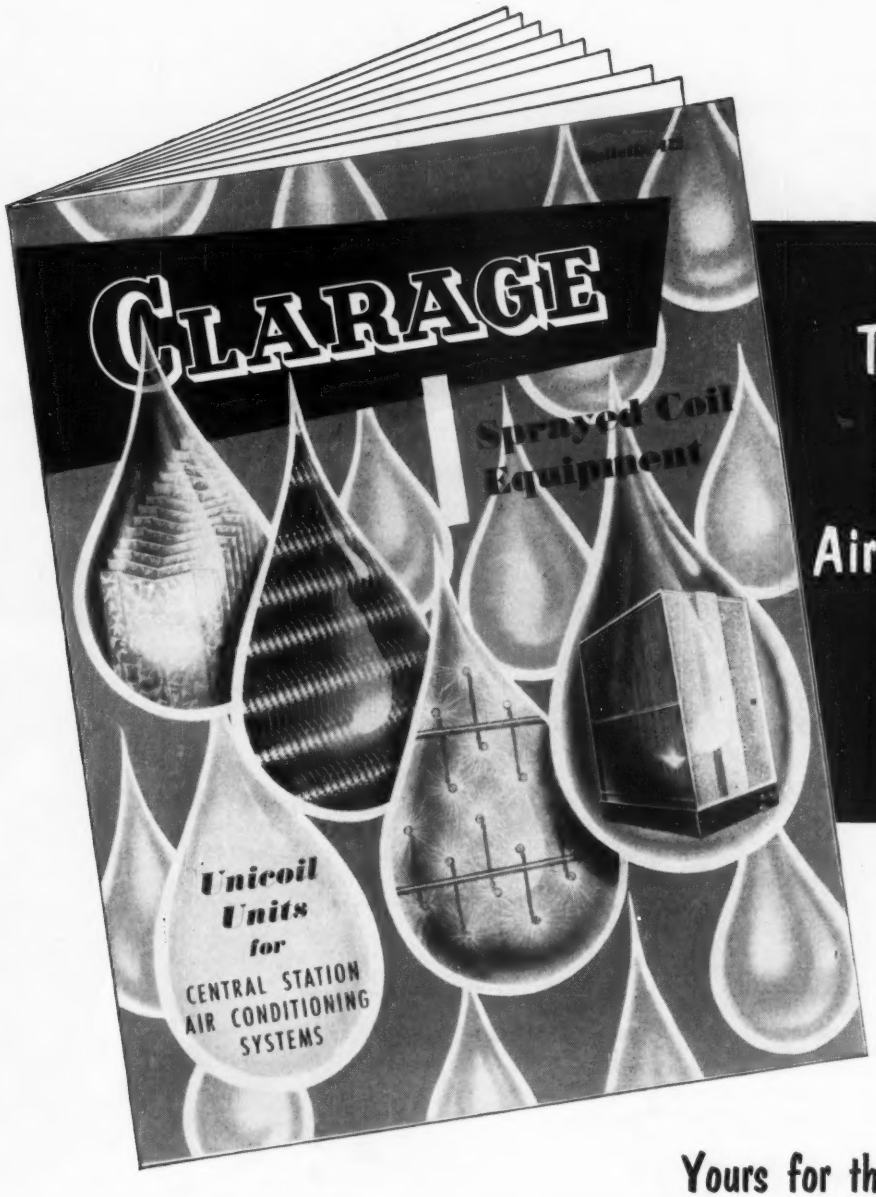
***District Sales Offices in Principal Cities***

Blank size: 3⅛" thick x 106½" OD

Blank size: ¼" thick x 75" x 88"



Blank size: 1½" thick x 26" OD




## This belongs in your Air Conditioning "Library"

**Yours for the asking** – 24 pages of information covering the new line of Clarage Unicoil Units. Principally designed for cooling and dehumidifying service in central station systems, this Sprayed Coil Equipment provides numerous advantages. Write today for Catalog 411 and discover why you'll be ahead in every respect by choosing the Unicoil. CLARAGE FAN COMPANY, Kalamazoo, Michigan

**This, too, you'll want**

72-page Clarage Service Manual provides valuable material adaptable to virtually any air handling or conditioning job.

**CLARAGE**

***... dependable equipment for making air your servant***

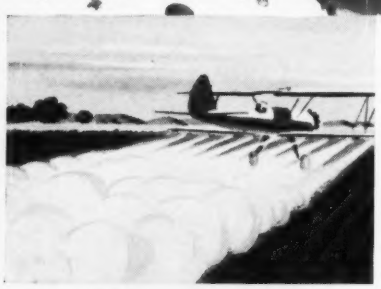
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Republic Benzols are used in making synthetic rubber for tires and for nylon in the cord. Xylols used in making paints, help provide protection and attractive appearance for farm and garden equipment.

**SULPHATE OF AMMONIA IS PROVED ON REPUBLIC'S OWN FARM.** Regular applications of fertilizer, blended with Republic Sulphate of Ammonia, prove the efficiency and top quality of this important source of nitrogen at Republic's research and development farm. Worn-out land has been seeded with grass, some acres fertilized with sulphate of ammonia and irrigated with Republic Steel Pipe. Weighing the cattle every week shows how much extra grass, and therefore meat, comes from fertilizing and irrigating.

**BUT THERE'S MORE TO RAISING CATTLE** than providing feed and forage. Strong, healthy cattle reach marketable size faster. Industrial Xylols produced by Republic, are used in the manufacture of germicides which protect cattle and other livestock from germs and microorganisms.

Republic Plastic Pipe, widely used on farms for watering lines, has many applications in chemical processing. It is highly resistant to acids, alkalies, metallic salts and corrosive wastes, and is immune to electrolytic action.



**THE CROP-DUSTING AIRPLANE** is a familiar sight across rural America. Agricultural chemicals, both spray and dust types, are applied in either of two ways, by aircraft or row crop sprayer. These chemicals help farmers control pests, weeds and plant diseases. This in turn leads to better crops and increased output per acre. Republic Benzol is a basic material used in the production of one of the most common of these chemicals, DDT.

# Look what's happened down on the farm

What farm? Any farm from the largest cattle and wheat ranches to the backyard, do-it-yourself type of operation shown at left.

Farm output per acre has increased 40% since 1940. Output per farmer has increased 87%. These increases have occurred on the same number of acres, but with fewer farmers doing the work.

What's happened? The inefficiency has been taken out. Improved technology, better equipment and machinery have been put in.

Republic makes many types of steels that go into farm equipment and machinery: alloy steel for motorized equipment and implements, high-strength steel for structural parts, pressed steel for housings, tubular steel for handles and frames, even fabricated steel parts for garden equipment.

**BUT REPUBLIC CONTRIBUTES MORE THAN STEEL**

Valuable coal chemicals from Republic's coke ovens are helping to restore ruined, arid and farmed-out land to fruitful production. They are helping to protect cattle from disease and reach marketable size, faster. Crops are made more resistant to the ravages of pests, insects and diseases. Buildings and equipment last longer.

Coal chemicals are another example of Republic diversification. Republic is a basic producer of many chemicals derived from coal—benzols, toluols, sulphate of ammonia, xylols, tar, crude naphthalene, pyridine and heavy crude solvent. In fact, of the 48 coke-oven producers furnishing two-thirds of the nation's supply of coal chemicals, Republic is one of the largest.

And, like the steel Republic makes, quality is controlled at every stage of production, from mine through coke oven, to the final processing of the coal chemicals.

Which of the Republic Coke-Oven Chemicals discussed below can you use in your product or process?

## REPUBLIC STEEL

*World's Widest Range of Standard Steels and Steel Products*

**COAL CHEMICALS IN THE KITCHEN.** Naphthalene is used in the making of synthetic enamels. Applied to the surface of steel products, like Republic Steel Kitchens, they provide a fine surface finish that stands up to all types of wear and tear and keeps products new looking longer. Benzol is used in making plastics for housewares and floor tile. It's also used in detergents, soaps, degreasers, and in dyes for coloring cloth and fabric.

**THE MEDICINE CABINET REVEALS** numerous uses of coal chemicals, like pharmaceuticals made from Toluols and coal-derived Pyridine. Toluols are also used in making milady's perfume. Benzols are used in the manufacture of plastic shower curtains, synthetic-rubber bath mats and in nylon thread for all types of wearing apparel, like nylon stockings.

Additional information and literature on any of the Republic products discussed on these pages can be obtained by mailing the attached coupon.

REPUBLIC STEEL

**REPUBLIC STEEL CORPORATION**

3116 E. 45th St. • Cleveland 27, Ohio

Please send more information on:

- ☐ Republic Coal Chemicals
- ☐ Republic Steel Pipe
- ☐ Republic Plastic Pipe

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

K-9997

The thousands of popular magazines on America's newsstands are made economically possible in large part by "Virginia" Zinc Hydro.

# "VIRGINIA" ZINC / HYDRO REDUCES PAPER MAKING COSTS

## Maybe it can save money for you, too

Paper makers wanted a magazine sheet that could be sold for less than pure sulphite. "Virginia" Zinc Hydrosulphite ($ZnS_2O_4$) was used to brighten low-cost ground-wood to a point high enough so that this brightened furnish when mixed with bleached sulphite produced a sheet of desired color and strength.

Of course, your business may not be paper making. But "Virginia" reducing and bleaching agents, $SO_2$, Zinc Hydrosulphite and Sodium Hydrosulphite, are stellar performers in 40 diverse industries. We're always glad to discuss your particular problem.

"Virginia" technical men have the know-how and experience to help you get the quickest answers. Perhaps there are some properties of these "Virginia" Chemicals that you've overlooked. We shall welcome the opportunity of reviewing them in terms of your process, in your plant. **Industrial Department, VIRGINIA SMELTING COMPANY, Box 21, West Norfolk, Virginia.**

VIRGINIA Chemicals

Field Offices: NEW YORK • BOSTON • DETROIT
CHICAGO • ATLANTA • ASHEVILLE
*Available in Canada and many other countries*

SO EASY TO PUMP FLUIDS

**through process lines of CHASE® COPPER TUBE!**

The coefficient of friction takes a beating inside process lines of Chase copper tube! The inside of this clean tube is satin-smooth, so even the heaviest industrial fluids flow more easily. That means pumps need not strain to keep fluids moving—*pumping costs stay low!*

Tests actually show that coefficients of flow remain essentially unchanged with *time* or *quantity of liquid* pumped through Chase copper tube. This is not true of other metals where clogging *rapidly increases* resistance to flow. What's more, Chase copper tube is corrosion-resistant—can't clog with *rust!*

Your Chase wholesaler or the Chase warehouse near you can give you full information on Chase copper tube. *Call them!*

Chase®

**BRASS & COPPER CO.**

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THE NATION'S HEADQUARTERS FOR BRASS, COPPER AND STAINLESS STEEL

*Warehouses and Sales Offices at:* Atlanta • Baltimore • Boston • Charlotte† • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Grand Rapids† • Houston • Indianapolis • Kansas City, Mo. Los Angeles • Milwaukee • Minneapolis • Newark • New Orleans • New York • Philadelphia • Pittsburgh • Providence • Rochester† • St. Louis • San Francisco • Seattle • Waterbury • (†sales office only)

*Sales Representatives at:* Albany, New York • Bridgeport, Connecticut • Cedar Falls, Iowa • Dayton, Ohio • Greensboro, North Carolina • Hartford, Connecticut • Jackson, Mississippi • Louisville, Kentucky Memphis, Tennessee • Miami, Florida • Oakland, California • Portland, Oregon • Richmond, Virginia • Rockford, Illinois • South Bend, Indiana • Springfield, Massachusetts • Tulsa, Oklahoma • Washington, D. C. • Wichita, Kansas

to regulate and record—

# TEMPERATURE.. PRESSURE.. VACUUM..TIME

*mechanical instruments by*

**WESTON**

**RECORDING INSTRUMENTS . . .** in 9", 10" and 12" chart sizes — single and multipen — for all requirements.

**RECORDING CONTROLLERS . . .** handle temperatures from −325°F to 1000°F—vacuum to 30" mercury — pressures to 7500 psi or higher.

**TIME CONTROLLERS . . .** make any semiautomatic retort control system fully automatic. Available in both standard and special forms.

**INDICATING CONTROLLERS . . .** accurately regulate temperature, vacuum, pressure and indicate on direct-reading scale.

**DIAL THERMOMETERS** (remote reading) . . . furnished with mercury, gas, or vapor pressure actuations. Flush or wall mounting. Indicate low as −325°F., high as 1000°F.

*Just Published!*

Just published . . . the new catalog M2A which fully illustrates and describes the comprehensive line of WESTON mechanical instruments, noted for their long-time accuracy and dependability. Send for your copy today; or ask your local Weston representative for help on any measurement or control problem involving temperature, vacuum, pressure. Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey, *a subsidiary of Daystrom Incorporated.*

**WESTON** *Instruments*

# years ahead!

# A VERTICAL SPLIT CASE PUMP

**6 STAR FEATURES**

## B & G SERIES 1510

### TYPE B CENTRIFUGAL PUMP

**. . . with balanced loading of impeller and bearings . . . handles loads far in excess of those produced by any pump and motor combination! Easily serviced without breaking pipe connections!**

1. **Leak-proof Mechanical Seal.** Features the exclusive, harder-than-glass B & G "Remite" insert. This Seal construction has enabled nearly two million B & G Pumps to make an amazing record for failure-proof performance.

2. **Hydraulically Balanced Impeller.** Balancing chamber and pressure relief holes in the impeller reduce thrust to a minimum, lengthening pump life.

3. **Solid-type Volute with Support Foot.** Can be left in pipe line when servicing pump —rugged construction absorbs piping strains.

4. **Removable Bearing Frame.** Complete bearing frame, including seal and impeller, can be removed without disturbing piping or motor leads. The bearing frame is replaceable and interchangeable on all sizes.

5. **Anti-Friction Roller Bearings.** Timken Bearings handle thrust and radial loads for smoother, quieter, more efficient operation.

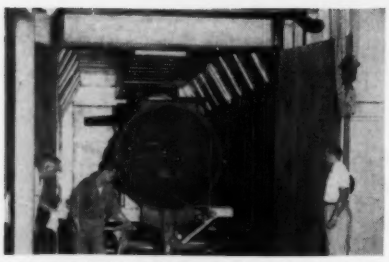
6. **Oil Lubrication.** No messy, undependable grease cups—circulating oil lubrication assures positive protection to bearings. Oil level indicator permits visual check.

**STOCK PUMPS!**

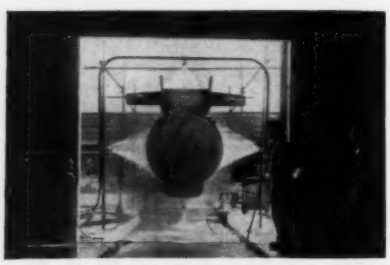
Selected sizes of B & G Series 1522 and 1531 Centrifugal Pumps are stocked at the factory for immediate shipment. Capacities to 225 GPM, heads to 140 ft. Send for Price and Selection Catalog.

**BELL & GOSSETT**
**COMPANY**
**Dept. ED-14, Morton Grove, Ill.**
*Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada*

# KEL-F® dispersion-coated tank truck transports corrosive chemicals



BAKE OVEN at Kellogg Plant, Jersey City, N. J. Overall length 85 ft., width 12 ft., height 12 ft., iso-thermal control, ±5°F. This new Kellogg oven is being used to develop improved techniques for large area applications.



QUENCHING – After final baking, tank is quenched to produce tough, transparent, flexible coating.

This tank, which is designed to transport corrosive chemicals without danger of contamination of the final product, was spray coated with KEL-F Dispersions at the Kellogg plant in Jersey City, and baked-fused in a specially built oven large enough to complete each coating in a single operation. Preliminary tests were carried out with a slightly smaller tank, and the correct techniques developed before proceeding with the coating operations on the tank truck.

## KEL-F DISPERSIONS—NEW WEAPON IN FIGHT AGAINST CORROSION

KEL-F Dispersions are finely divided fluorocarbon plastic solids in a volatile medium. Applied by spray, dip or spread coating, they are fused by heat into a tough, impervious coating – firmly bonded to the surface on which applied, and providing a chemical and temperature resistant surface that is anti-sticking and self-cleaning.

This liquid chemical carrier is evidence that the range of applications for KEL-F Dispersions is not limited by size, and that present techniques of dispersion coating can be applied to tanks and other outsize equipment. There are experienced applicators of KEL-F Dispersions, serving nearly every major industrial area. They can show you how this fluorocarbon polymer can come to your aid in your fight against corrosion and high processing temperatures. For more information, send for KEL-F Dispersion Manual, and list of applicators.

KELLOGG

**THE M. W. KELLOGG COMPANY**
*Chemical Manufacturing Division, P. O. Box 469, Jersey City, N.J.*
**SUBSIDIARY OF PULLMAN INCORPORATED**

® Registered trademark of The M. W. Kellogg Company's fluorocarbon polymers

# VULCAN
## CAN CUT YOUR BIG GEARS

### at the Highest of Speeds with the NEWEST and one of the LARGEST GEAR SLOTTERS in the UNITED STATES

Illustration shows the newest of three vertical slotters now in operation at the VULCAN IRON WORKS.

This slotter is screw driven with a reversing motor drive, and has a maximum vertical stroke of 44″. The head that carries the cutting tool has 48″ of cross travel on the cross rail. All material to be cut is placed on a revolving work table, and this equipment is tooled up to automatically cut teeth 40″ deep on gears up to 20′ in diameter.

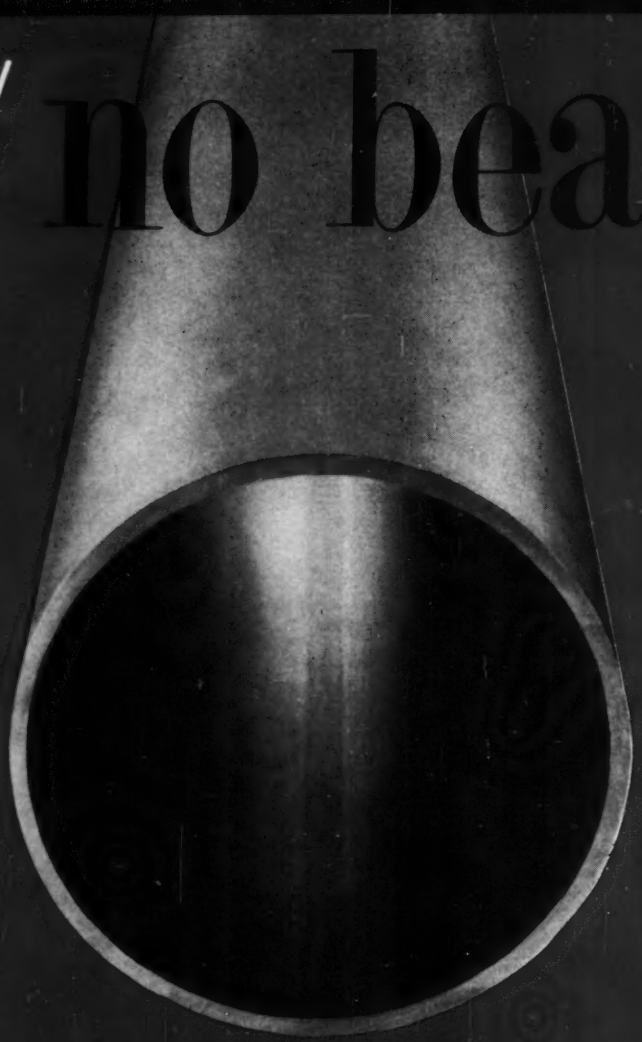
This newest addition to VULCAN equipment means that VULCAN can now turn out your gears at the Highest of Speeds, and with the Highest of Quality.

Whatever your gear problems may be . . . Write today for full information on what VULCAN can do for you . . . No obligation, of course.

**VULCAN IRON WORKS**

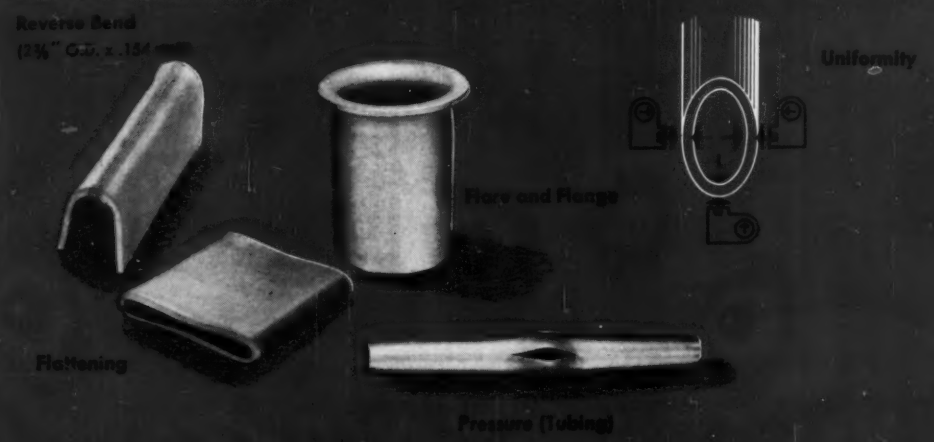
WILKES-BARRE, PA., U.S.A. CABLE ADDRESS "VULWORKS WILKESBARRE" ESTABLISHED 1849

NOW no bead,



Photograph of Contour-Welded 3" I.P.S. Schedule 10 pipe Type 304

CONTOUR-WELD PIPE...BEST BY ANY TEST YOU CAN NAME



# no undercut

## *in new type welded stainless steel pipe*

Now, TRENTWELD is better than ever! Thanks to Trent's new patented *Contour-Weld** process, you can now get stainless pipe or tubing that's really smooth inside . . . free from any undercut or projecting weld bead.

***Check these Benefits***

As before, this new-type TRENTWELD is made from uniformly rolled stainless strip. That's why you'll always get extremely high uniformity both of wall thickness and curvature. And Trent's new *Contour-Welding* brings that same uniformity to the weld zone itself. This means a stronger pipe or tube with smoother flanged or flared ends . . . no cavitation corrosion or erosion . . . better performance in every category than with any other, welded or not.

Try new Trent *Contour-Welded* pipe or tubing for yourself. It's a natural for pressure lines . . . lines carrying corrosive chemicals . . . high-velocity systems. And remember, it's made by Trent—tube-mill specialists.

**Why Trent's Exclusive *Contour-Weld* Process Means Smoother Welds . . .**

*With conventional welding, gravity means beads . . .* or undercut, particularly in heavy sections. Gravity pulls some of the molten metal down into the pipe to form a bead that is extremely difficult to remove by cold working. And cold working of the inside bead can lead to undercuts, focal points for erosive and corrosive attack. Cleaning becomes difficult.

*With new* Contour-Welding, *gravity means smoothness.* Trent's new *Contour-Welding* puts gravity to work. The pipe is inverted, and welded at the bottom. Gravity still pulls the molten metal down — but that simply makes the weld-bead contour correspond to the contour of the pipe itself. That's why there's no tell-tale bulge of weld metal on the critical inside surface. And even on the outside, the weld bead more closely approaches that of the parent metal than other welded pipe.

Contour-Weld is the trade mark of the Trent Tube Co. for its process of welding pipe and tubing which is protected under U.S. Patent 2,716,692.

**TRENTWELD** **STAINLESS STEEL TUBING**

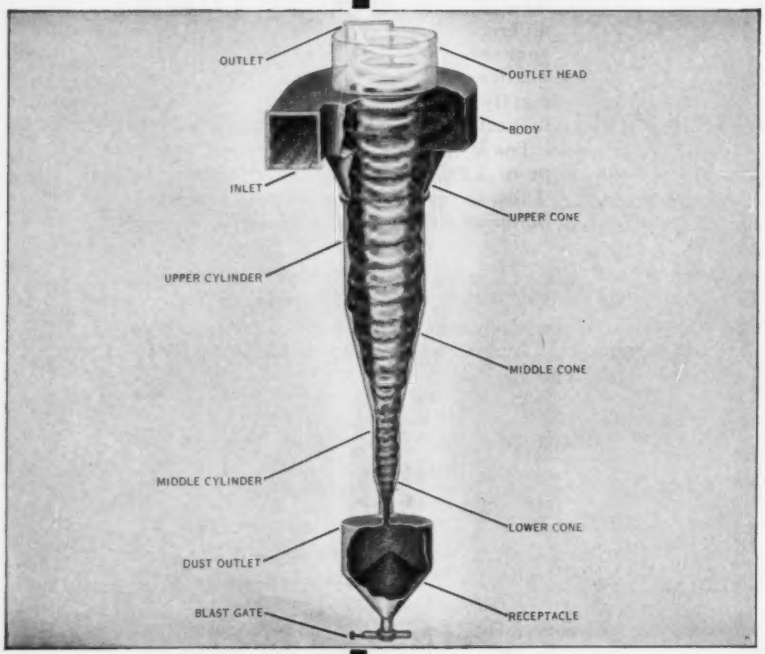
TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)



**The best way to get the most for**

## American Blower Dust Collectors

# Recover valuable materials, eliminate nuisances




### Mechanical type collectors offer high efficiencies over wide range

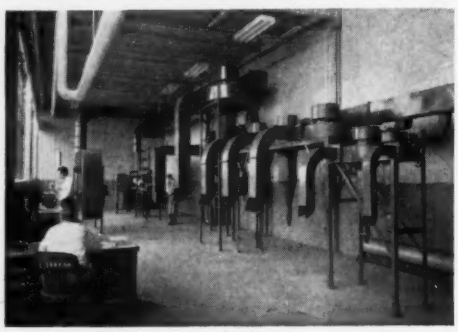
*Simplicity* in principle and design is the key to the efficient operation of American Blower Type D Dust Collectors. There are no rotating parts to adjust or repair. No water, oil or other collecting substances, which might cause corrosion or plugging, are used.

As a result, American Blower high-velocity mechanical collectors are widely used in industry as a means of eliminating a dust nuisance or to recover valuable materials from air.

If you have a problem in dust collection, consult the nearest American Blower Branch Office, or write stating your requirements.

**Complete dust laboratory to serve you**

Technical information, obtained from thousands of tests in our laboratory and in the field, has provided our engineers with an extensive file on dust problems and covers thousands of dust samples. Engineers are invited to make use of our complete dust-research laboratory where tests can be made on commercial-sized collectors.



**American Blower products serve industry**

Air Conditioning, Heating, Ventilating Equipment
Mechanical Draft Equipment
Industrial Fans and Blowers
Centrifugal Compressors
Gyrol Fluid Drives
Dust Collectors

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

**AMERICAN BLOWER**

*Serving home and industry:* AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE
DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

# The best way to get the most for your tube steel dollar: *Ask the experts!*

*This month's report is on:* **2% CR.-MO.**

Has intermediate corrosion resistance in combination with good creep strength and fair resistance to oxidation. For use at temperatures up to 1200°F. in cracking coils, reforming units, heat exchangers, vapor line and hot oil piping, and return-bend forgings for oil heaters.

**ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS**

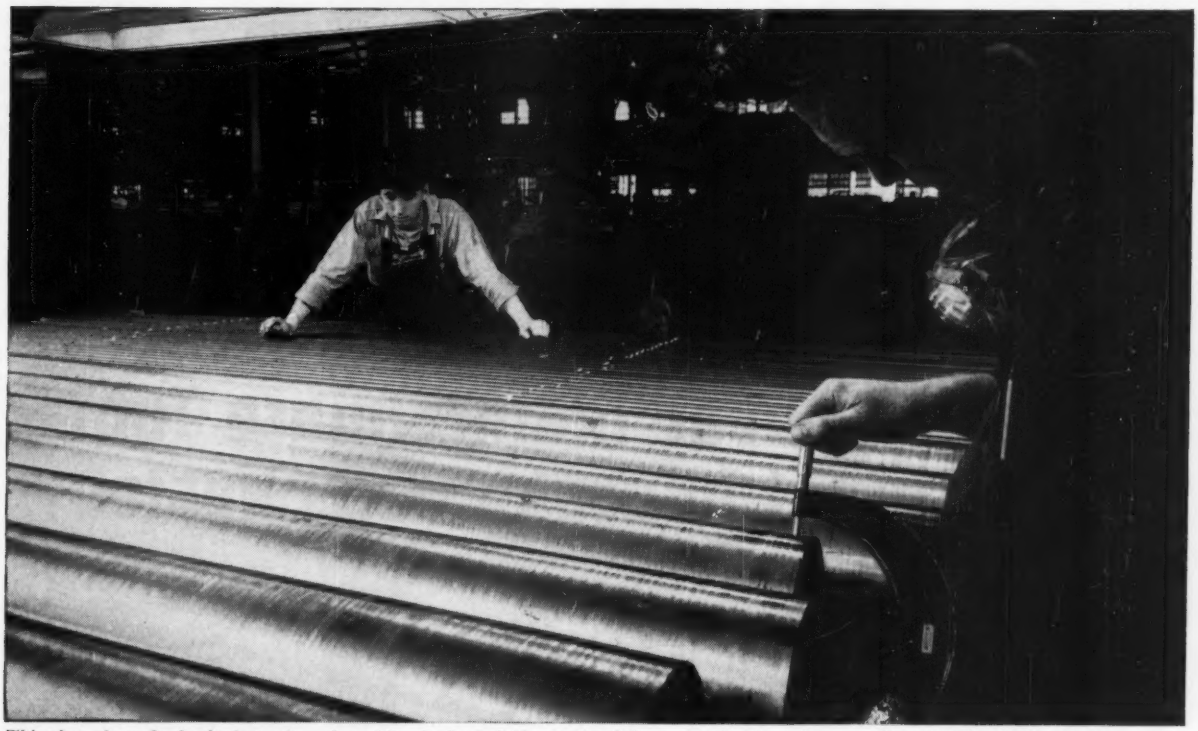
| | | | |
|---|---|---|---|
| Carbon | Sicromo 2 | Sicromo 5S | 18-8Ti |
| Carbon-Mo. | Sicromo 2½ | Sicromo 5MS | 16-13-3 |
| DM-2 | 2½% Cr.-1% Mo. | Sicromo 7 | 25-20 |
| Silmo | Sicromo 3 | Sicromo 9M | 25-12* |
| DM | 4-6% Cr.-Mo. | 18-8 Stainless | 35-15** |
| 2% Cr.-Mo. | 4-6% Cr.-Mo.-Ti. | 18-8 Cb | 16-25-6** |

** Available as seamless tubing on an experimental basis only.*
***Not available as seamless tubing.*

THERE are probably several high temperature tube steels that will solve your heat, pressure, corrosion or oxidation problems. But there's only one that will give you the most for your tube steel dollar—the best life/cost ratio.

The best way to find it is to ask Timken Company metallurgists. They're recognized authorities on high temperature steels. With 23 years of experience behind them, they can help you select your best steel from 24 different analyses. You'll be sure of getting the most for your tube steel dollar. And you'll be assured of uniform quality in every tube because The Timken Company rigidly controls quality from melt shop through final inspection.

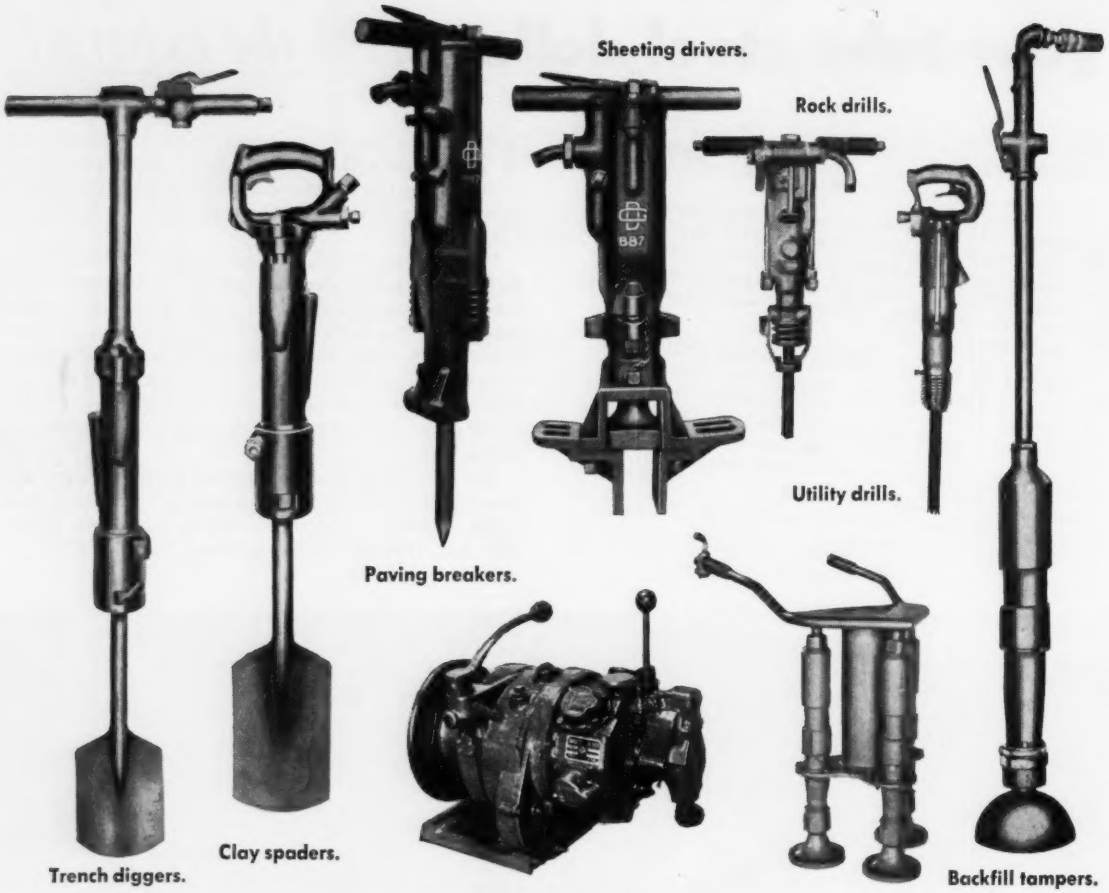
For help with your tube steel problems, *ask the experts!* The Timken Roller Bearing Company, Steel & Tube Division, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



*This photo shows final tube inspection—last of hundreds of rigid tests that help account for the uniform quality of Timken high temperature steels.*

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

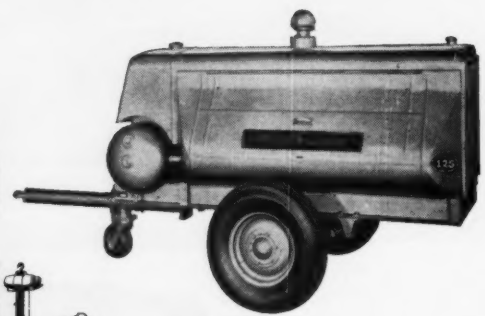
**SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING**




# Gardner-Denver Maintenance Tools make plant housekeeping easier

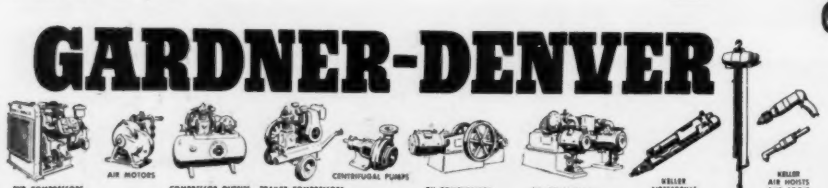
Good industrial maintenance often calls for concrete demolition, masonry drilling, heavy lifting, tough digging, firm backfilling — jobs done quickly and easily by the crew that's equipped with these costsaving Gardner-Denver Air Tools —

**Write for descriptive bulletin.**



The Gardner-Denver WH-125 — puts compressed air where you need it for operating these tools — for cleaning — for paint spraying.

## GARDNER-DENVER




THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

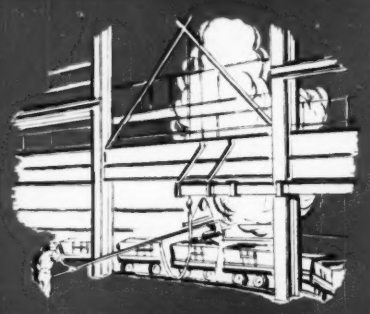
**Gardner-Denver Company, Quincy, Illinois**

**In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario**

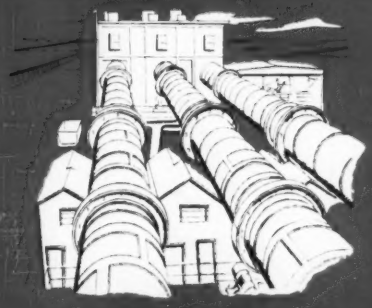
# Harbison-Walker
# REFRACTORIES

## serve every chemical processing need

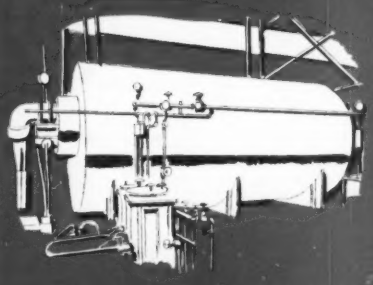
To meet the wide variety of conditions that prevail in chemical processing equipment, Harbison-Walker provides a complete line of refractories from which can be selected the exact types and classes needed for longest life and most economical service. Technical service based on the most extensive experience and research is freely offered for assistance in determining the proper refractory for every specific requirement.



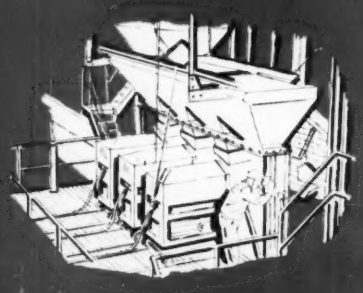
CALCIUM CARBIDE FURNACE



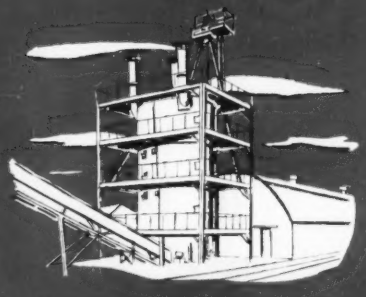
ROTARY KILNS



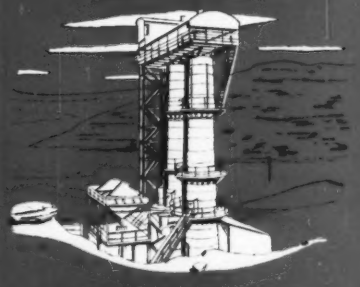
SULPHUR BURNER



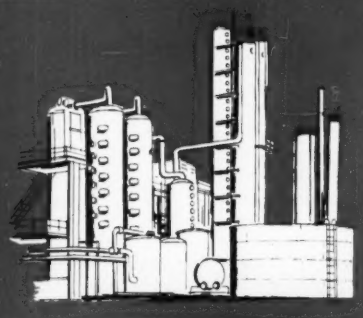
SILICATE OF SODA FURNACE



ROASTER FURNACE

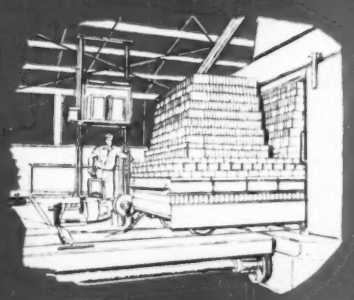


SHAFT KILN



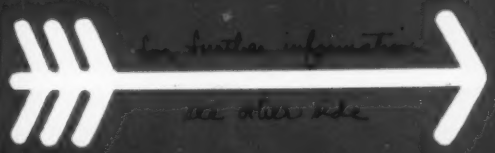
TOWERS AND TANKS

BOILER FURNACE



TUNNEL KILN

**HARBISON-WALKER REFRACTORIES CO.**
and Subsidiaries
*WORLD'S LARGEST PRODUCER OF REFRACTORIES*
GENERAL OFFICES: Pittsburgh 22, Penna.



# Harbison-Walker Products

## for greatest durability and economy in all refractories applications

The true cost of refractories is not measured by their cost per thousand. The proper criterion for the value of a refractory material is its effect upon the overall costs of production per unit of output—whether it be a ton of chemicals, a pound of titanium, or a unit of any other product. Obviously it is very important that refractories be selected with extreme care in order that the kind best suited for the particular operating conditions be used to secure maximum service life with the least maintenance interruption and production loss.

Harbison-Walker produces more than fourscore types and classes of refractories from which can be made the best balanced selection. Four general classifications are illustrated below.

Bonding Mortars with characteristics matching the brick assure most satisfactory service.

### Refractory Brick and Mortars

The types of Harbison-Walker dense refractories used in the chemical processing industries include high-alumina and fire clay (all classes), basic (magnesite, chrome and forsterite), silica (super-duty and conventional) and chemical-proof brick.

Harbison-Walker makes insulating fire brick (six brands), lightweight silica brick, block insulation and castables of high insulating value.

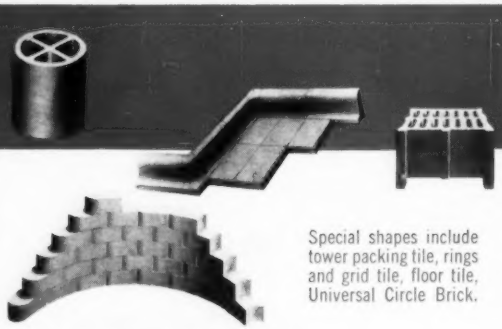
### Insulating Refractories

For the insulation of industrial furnaces many combinations of insulating fire brick and other refractories may be used with greatest advantage. With the full complement of insulating fire brick and refractories of all kinds, Harbison-Walker can furnish the correct combination for any service requirement.

Plastic fire brick are available in both standard and super classes, Castables in a dozen specialized classes.

### Plastic and Castable Refractories

For many applications, monolithic furnace linings are used with good economy. Harbison-Walker offers the complete range of refractory materials in plastic and castable forms for such needs. Castables may be poured like concrete, trowelled, rammed or installed by air-gun application.



Special shapes include tower packing tile, rings and grid tile, floor tile, Universal Circle Brick.

### Acid-Proof Materials

Duro acid-proof brick and shapes are dense and vitreous, strong and abrasion-resistant, highly impermeable to gases and liquids, resistant to corrosive chemicals, and have refractoriness adequate for temperatures up to 2300°F. They are extensively used in a wide variety of chemical processing applications.

see other side

**HARBISON-WALKER REFRACTORIES CO.**

and Subsidiaries

WORLD'S LARGEST PRODUCER OF REFRACTORIES

GENERAL OFFICES: Pittsburgh 22, Penna.

*Here is*

# EXTRA MOTOR VALUE

**Double-shielded bearing**
**Large grease reservoirs**
**Bolted-on bearing cap**
**Labyrinth seals**

## This Allis-Chalmers Bearing Design Gives More for Your Motor Dollar

You can lubricate these bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at two points provide means for inserting new grease, flushing out old grease and relieving pressure during re-greasing.

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, minimizes the possibility of grease entering the interior of the motor . . . retains an ample supply within the bearing enclosure.

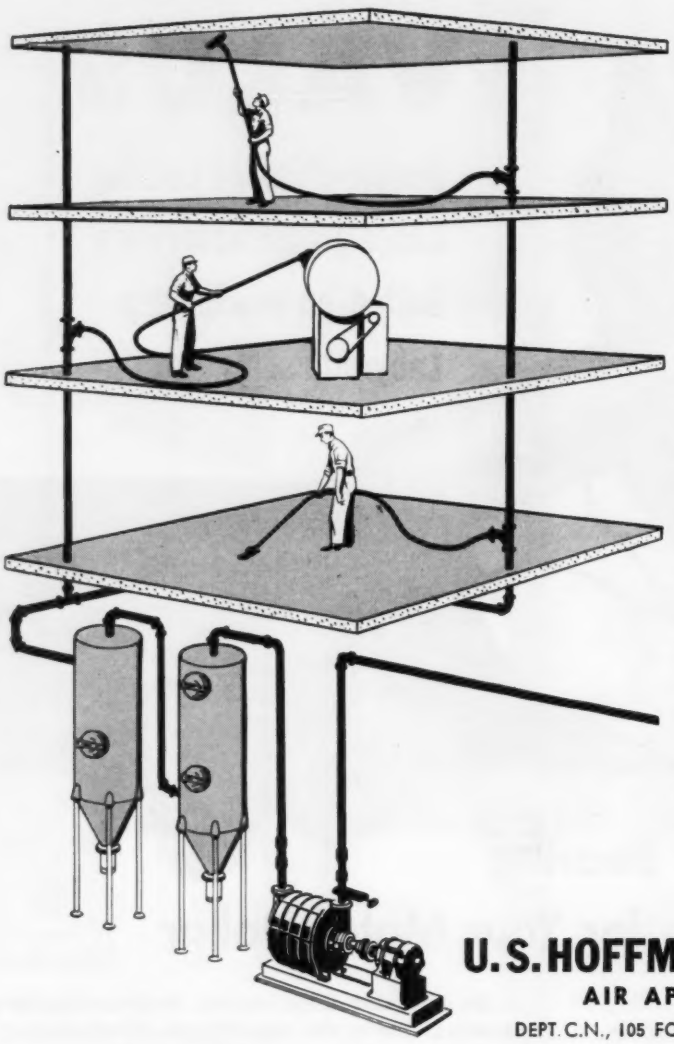
At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt barriers.

Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to give you the facts on this maintenance-saving design. Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 51B7286. A-4855

# ALLIS-CHALMERS

# HOFFMAN'S ENGINEERED SYSTEMS designed to do the tough jobs in industry

## FOR REMOVAL AND RETENTION OF CHEMICAL DUSTS, YOU CAN'T EQUAL A HOFFMAN BUILT-IN VACUUM SYSTEM



Combining the functions of a pneumatic conveyor system which unloads at a central point and a powerful, on-the-spot vacuum cleaner explains why the Hoffman Vacuum Installation is the "perfect performer" for clean-up and removal of dry chemicals and other materials.

Constant suction is piped to convenient outlets throughout the plant, and flexible hoses snap on to these outlets for quick thorough cleaning of walls, ceilings, equipment, and tables—as well as floors. A wide range of nozzle sizes and shapes makes it easy to dry scour any surface. And the powerful suction lifts and takes out just about anything that is dry and not nailed down.

All suction lines discharge into central collectors, where the transported matter is removed from the air stream and held for later salvage, disposal, or other treatment.

Heart of the Hoffman pneumatic systems is the famous, unique Hoffman Multi-Stage Blower and Exhauster—which serves equally well in supplying air pressure up to 9 lbs. psi, or vacuum to 12 inches Hg. These air movers are built to serve non-stop for long periods with minimum noise—no pulsation. They have no valves, vanes, pistons, gears, or other impacting and wearing parts to cause vibration and frequent maintenance.

When any form of pneumatic applications is a need, or problem, in your operation, call in the Hoffman engineers—first thing!

**U.S. HOFFMAN MACHINERY CORP.**
**AIR APPLIANCE DIVISION**
DEPT. C.N., 105 FOURTH AVENUE, NEW YORK 3, N. Y.

**INDUSTRIAL FILTRATION DIVISION**

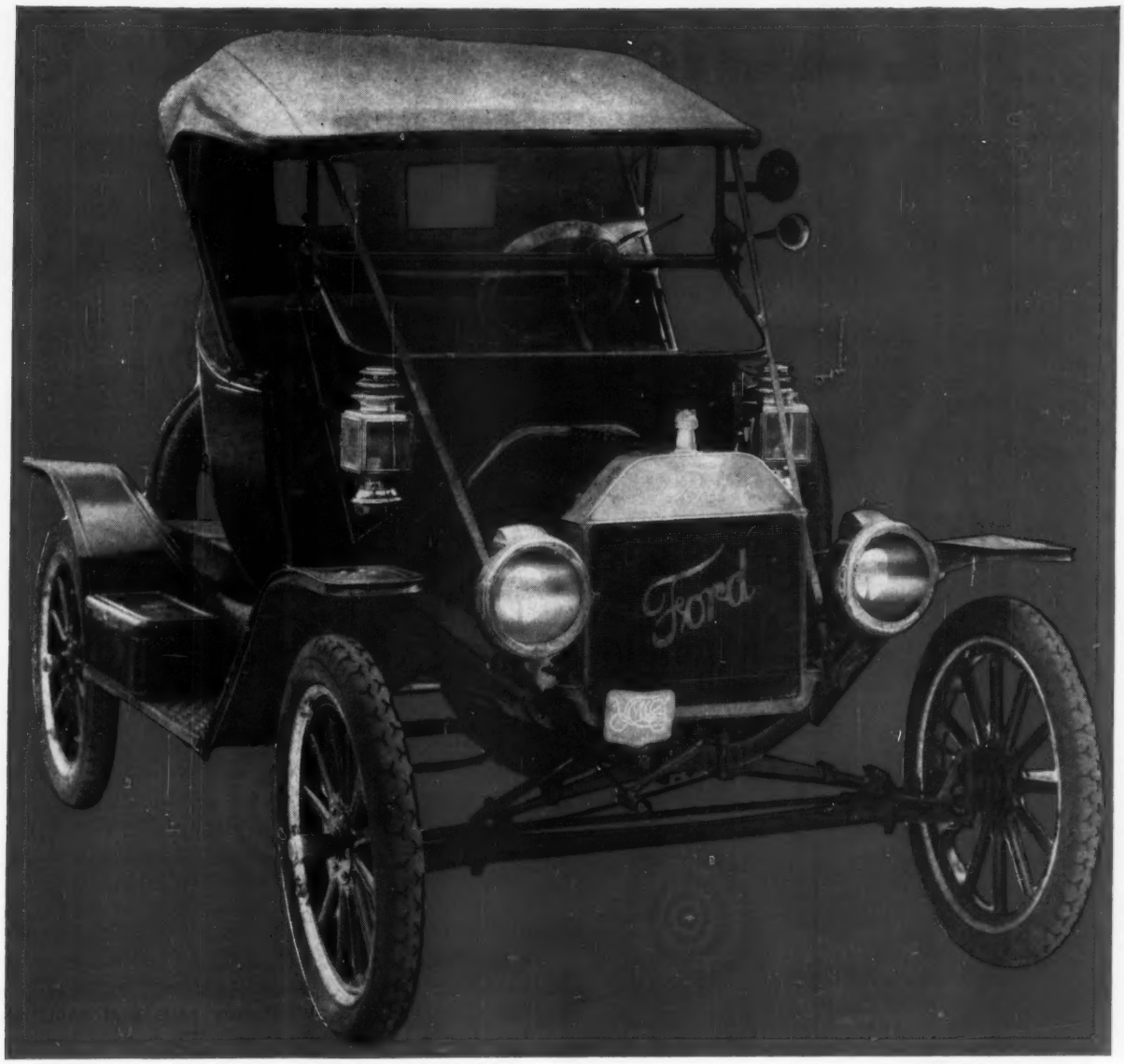
*Machine Tool Coolant Clarifiers—Flotation, Mechanical, and Magnetic.*
*Lubricating and Insulating Oil Conditioners, Filters, and Vaporizers*
*Solvent Recovery Systems—Vacuum Stills and Filters*

**METAL FINISHING DIVISION**

*Mechanized Metal Cleaning and Phosphatizing Systems*
*Chemical Plating Equipment*
*Electrostatic Spray Painting Equipment*
*Paint Booths and Bake Ovens*
*Filters for Phosphate and Plating Solutions—Waste Disposal*

**ORDNANCE EQUIPMENT DIVISION**

*Special Pneumatic Conveying Systems*
*High Efficiency Centrifugal Separators*
*Stationary and Portable Vacuum Cleaning Equipment*
*Process Equipment*
*Pneumatic Systems for Radioactive Materials*




# PROVED PERFORMER

This handsome little Ford runabout has had a well-cared-for life. Now, almost fifty years old, its engine purrs, its paint and brass gleam as though it were a youngster just off the assembly line.

Dependable quality that has stood the test of time is a point of pride in Esso Petroleum Solvents, too. Our production facilities and laboratories have been in the business for a long time, during which product quality has been developed to an amazingly high level. Find out for yourself, next time you order. Specify Esso Solvents – famous for their dependable high quality and performance.

**You can depend on Esso Solvents for**

**MULTI-STORAGE AVAILABILITY**—water terminals in industrial centers.

**MODERN HANDLING METHODS** – separate tank storage, pumping lines, tank cars and trucks are used in all handling operations. Prompt delivery to your door is assured.

**SOLVENCY** – Esso aliphatics and Solvesso aromatics cover both high and low solvency ranges.

**CONTROLLED EVAPORATION**—available in a wide range of evaporation rates with precise characteristics to meet your most exacting requirements.

**FOR TECHNICAL ASSISTANCE** – If you have a solvents problem or want further information on the specifications and characteristics of Esso Solvents—write or call our office nearest you. Our technicians will be glad to assist you.

ESSO

**PETROLEUM SOLVENTS**

**SOLD IN:** Me., N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Pa., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

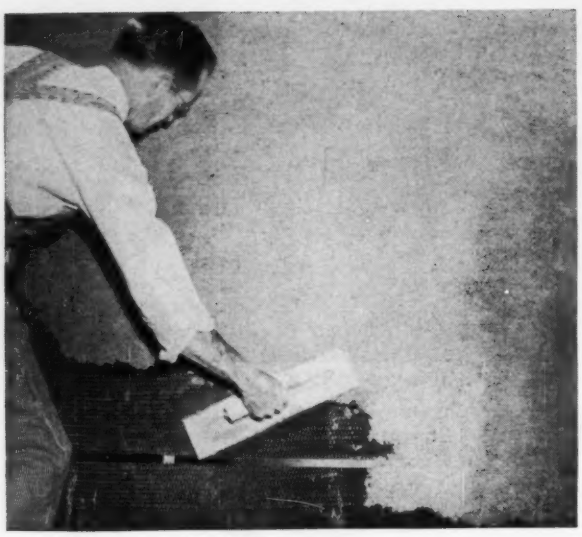
**ESSO STANDARD OIL COMPANY**

Boston, Mass. — Pelham, N. Y. — Elizabeth, N. J. — Bala-Cynwyd, Pa. — Baltimore, Md. — Richmond, Va. — Charlotte, N. C. — Columbia, S. C. — Memphis, Tenn. — New Orleans, La.

# EAGLE-PICHER

# ONE-COTE CEMENT

## *INSULATES, PROTECTS, FINISHES, in one quick application!*



**ONE QUICK APPLICATION** saves time, work and money. Eagle-Picher One-Cote Insulating Cement is clean, easy to handle—provides a smooth, light-reflectant surface. Just trowel it on *hot or cold* equipment—even *irregular* areas where application of other insulations is often impractical.

**ONE QUICK APPLICATION** assures a highly efficient insulating job that is effective at temperatures up to 1000F. In outdoor installations, quick-setting One-Cote Cement withstands rain and moisture two hours after application. When used indoors, you need no wire mesh or finishing treatment.

**ONE QUICK APPLICATION** gives you a fast-setting, rust-inhibitive combination that insulates, protects and finishes. One-Cote Cement spreads easily, gives exceptional coverage and is amazingly efficient.

***WRITE FOR FREE SAMPLE TODAY!***

Prove to yourself, on your own equipment, how Eagle-Picher One-Cote Cement can save you time, money and valuable man-hours!

*Since 1843*

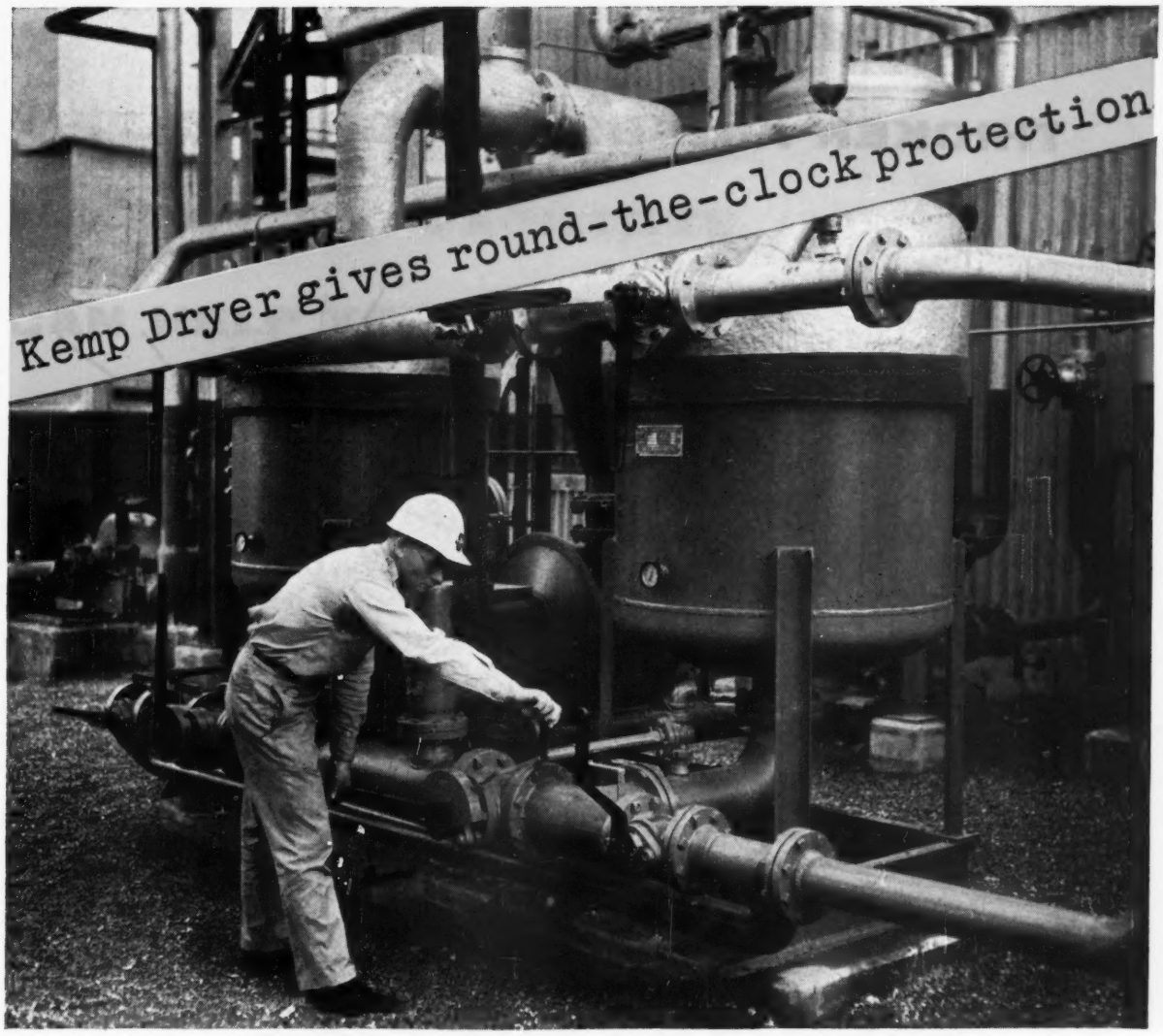
EAGLE EP PICHER

**THE EAGLE-PICHER COMPANY**

Producing a complete line of industrial insulations

**Cincinnati 1, Ohio**

*(Member of Industrial Mineral Fiber Institute)*




## Grace Chemical Company Reports: *Kemp Dryer safeguards instruments throughout plant 24 hours per day*

The Grace Chemical Co. manufactures Anhydrous Ammonia and Urea 24 hours a day at Woodstock, Tenn. This operation demands instrument accuracy with a minimum of maintenance and downtime. To increase instrument efficiency by preventing corrosion and costly line freezes, Grace Chemical installed a Kemp Dryer.

### Kemp Requires Little Attention

Semi-automatic, the Kemp Dryer works night and day drying compressed air for instruments and pneumatic controlled valves. According to operator Charles Lewis, the Kemp unit requires a bare minimum of attention.

### Kemp Dryers for Every Purpose

Kemp offers a variety of dryer models to meet all problems. Designed to dry air, gases or liquids to sub-zero dew points at a low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. Kemp Dryers are available with manual, semi-automatic, or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each drying job. If you have a problem involving the removal of water from air, gases, or liquids, contact Kemp engineers now. For complete facts and technical information, write for Bulletin D-29.

**KEMP OF BALTIMORE**

**DYNAMIC DRYERS**

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • INERT GAS GENERATORS
SINGEING EQUIPMENT

**THE C. M. KEMP MFG. CO.**
405 East Oliver Street, Baltimore 2, Maryland

# IF YOU'RE IN A HOLE OVER

# THICKER AND BIGGER SHELLS . . .

# KELLOGG'S EXPANDED FABRICATING FACILITIES CAN HELP YOU OUT

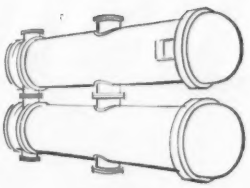
Why let shell geometry present a production bottleneck on urgently needed heat exchangers, towers, and other pressure vessels? M. W. Kellogg's expanded and complete fabricating facilities are geared to produce shells thicker, bigger, and in shorter time than ever before.

Production tools recently installed at Kellogg's New Jersey shop to meet increasing demands for larger vessels include: a planer capable of handling steel plate 40 feet long; huge bending rolls, augmented by a new, ancillary 2,000-ton press for bending plate up to 4 inches thick; and automatic welding equipment for longitudinal seams to 16 feet in length, and circular seams 12 feet in diameter.

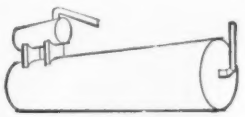
In heat treating, Kellogg now can handle vessels larger than a railroad car, with thirteen furnaces having temperature ranges from 1200 to 1950 deg. F. Its pipe bending facilities can shape carbon steel and alloy piping 36 inches in diameter—to exceptionally close tolerances. In nondestructive testing, Kellogg's latest addition is its Kel-Ray* Projector. Using gamma rays, this unique instrument permits the radiographic inspection of welded seams as thick as 6 inches in a single short exposure.

Backing up Kellogg's fabricating facilities are Kellogg engineers, who can either assume entire design responsibility or work closely with your own engineers; and Kellogg's staff of fabricating-welding engineers, who plan and administer a continuing personnel training program to qualify welders and mechanics on new techniques for fabricating new materials.

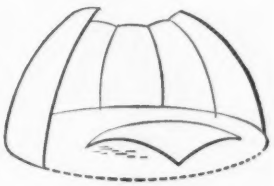
We welcome the opportunity to demonstrate what Kellogg's complete engineering and expanded fabricating service can do for *you*.



HEAT TRANSFER EQUIPMENT

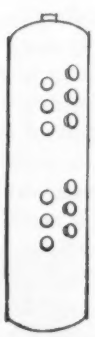


TANKS AND REACTORS



KNOCKDOWN VESSELS

PROCESS PIPING



PRESSURE VESSELS

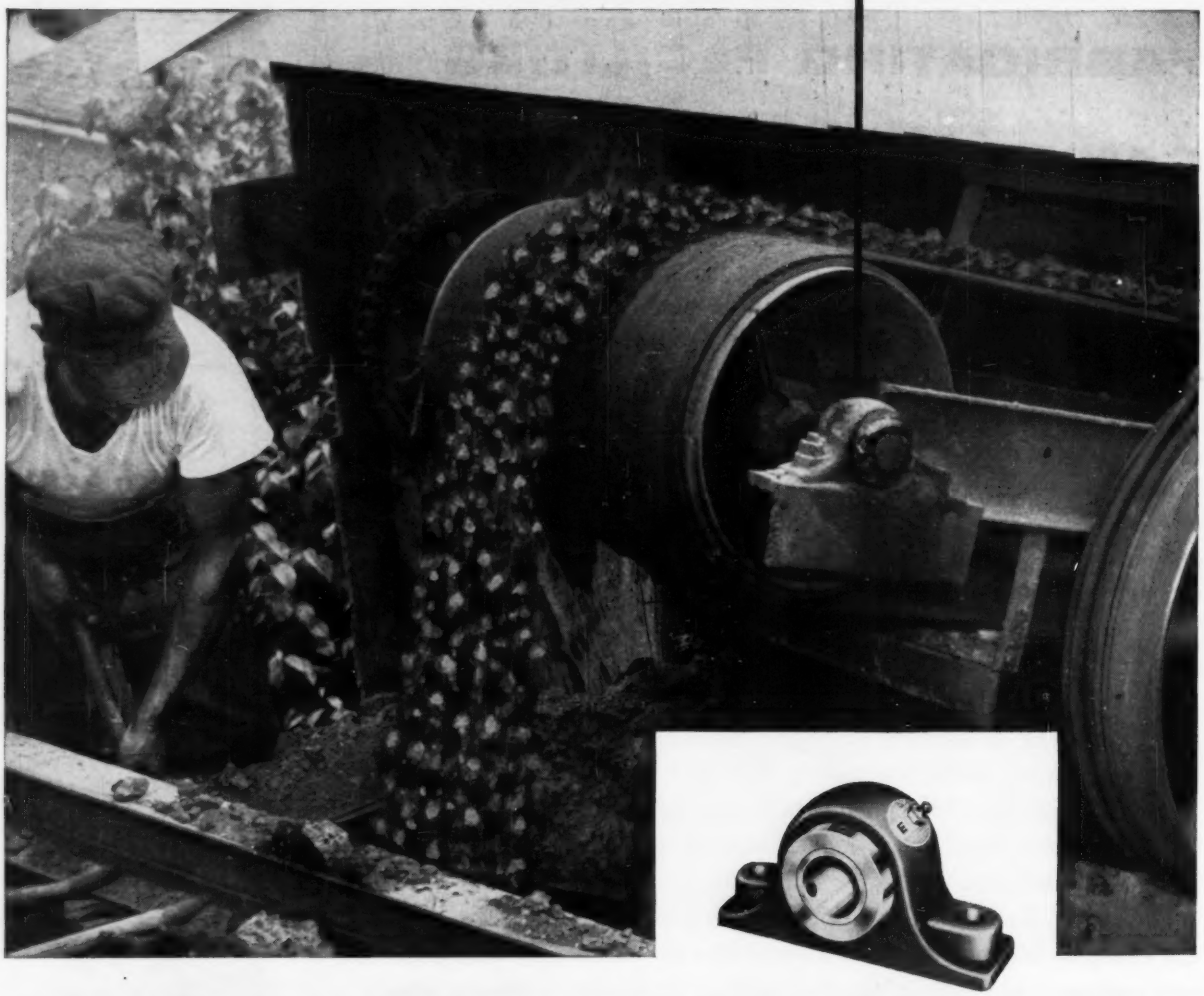
**FABRICATED PRODUCTS DIVISION**
**THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.**
*In Canada: The Canadian Kellogg Company, Limited, Toronto*
*In Europe: Kellogg International Corporation, London*
SUBSIDIARIES OF PULLMAN INCORPORATED

*Trademark of The M. W. Kellogg Company

**ENGINEERED FABRICATION BY** M KELLOGG W

**COMPLETELY ASSEMBLED**
**FACTORY ADJUSTED**
**PRE-LUBRICATED**

**SEALED**
*—ready to mount on the shaft!*



# DODGE-TIMKEN *America's Quality Pillow Block*

Extra measures are taken to build superior quality into Dodge-Timken Bearings; and extra precautions are taken to keep that quality *intact*—from the factory to distributor to you to your machines.

These bearings are sealed in manufacture—an integral part of Dodge-Timken design. Their inbuilt precision is protected *both on and off the shaft.* That is one reason why they easily deliver a minimum of 30,000 hours of service. Want evidence? Look around you. No other pillow block is so widely used on the nation's tough jobs. Dodge-Timken dependability has been proved in *millions* of installations.

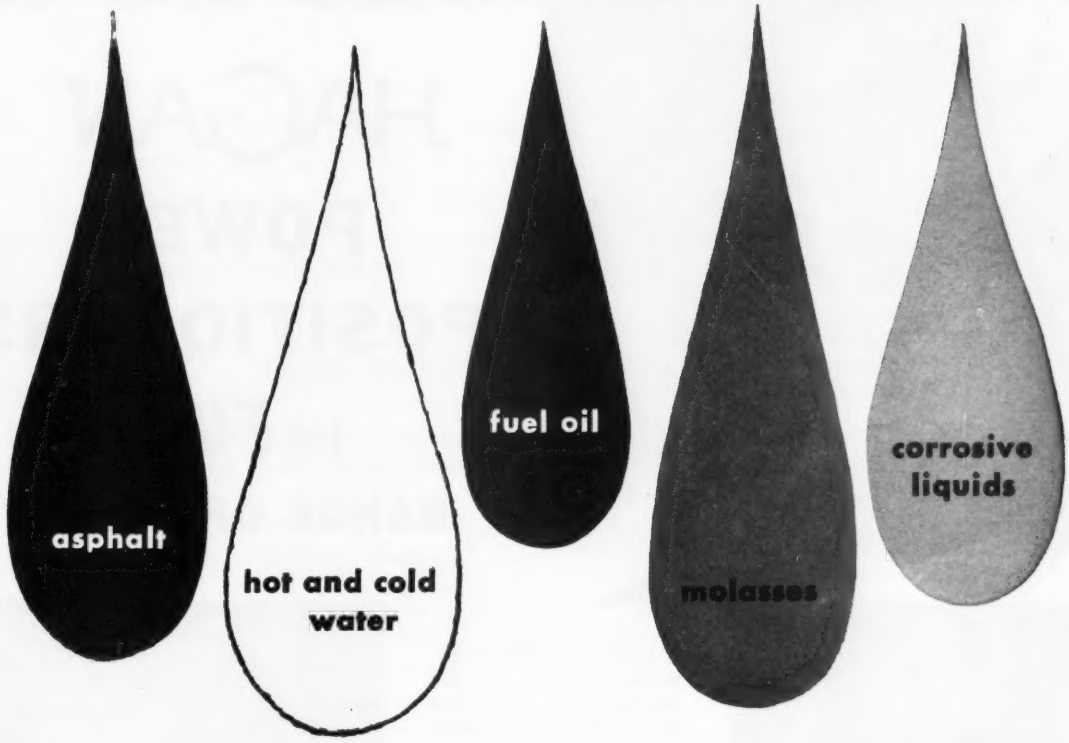
There are 5 types of Dodge-Timken Pillow Blocks for all types of service, in shaft sizes from 1 3/16" to 10". Also Dodge-Timken Hanger Bearings, Flange Bearings, Take-ups.

**DODGE MANUFACTURING CORPORATION, 200 Union St., Mishawaka, Indiana**

**DODGE**
**of Mishawaka, Ind.**

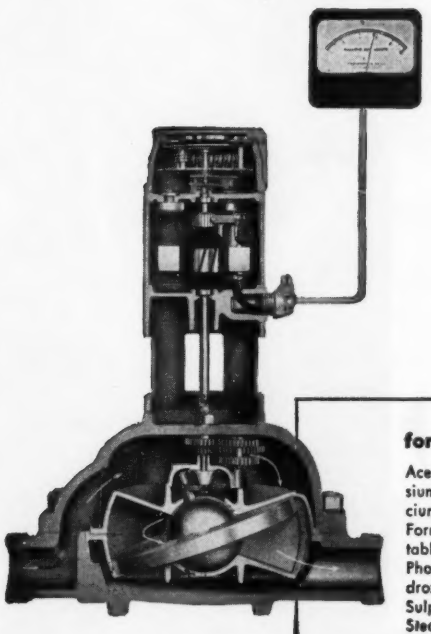
***CALL THE TRANSMISSIONEER,*** your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

# viscosities unlimited




## HAYS VERIFLOW METER AND HAYS ELECTRONIC VERITROL

### indicate and control liquid flow



Now virtually all fluids can be precisely measured and accurately controlled—*from a remote position.*

Hays VERIFLOW meter accurately measures, indicates, and totals the flow of corrosive and hard-to-meter liquids without using weigh tanks, orifice plates, or gage sticks.

With the Hays VERITROL you simply set a knob at the rate of flow desired . . . then, the VERITROL controls the flow of liquid at that set-rate.

***Send for a complete description of Hays Veriflow Meter and Veritrol, Pub. No. 53-766-38.***

**for corrosive liquids**

Acetic Acid, Aluminum Potassium Sulphate, Ammonia, Calcium Compounds, Carbolic Acid, Formaldehyde, Fruit and Vegetable Juices, Hydrogen Peroxide, Phosphoric Acid, Potassium Hydroxide, Sodium Compounds, Sulphuric Acid (concentrated), Stearic Acid, and many others.

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • $CO_2$ Recorders
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

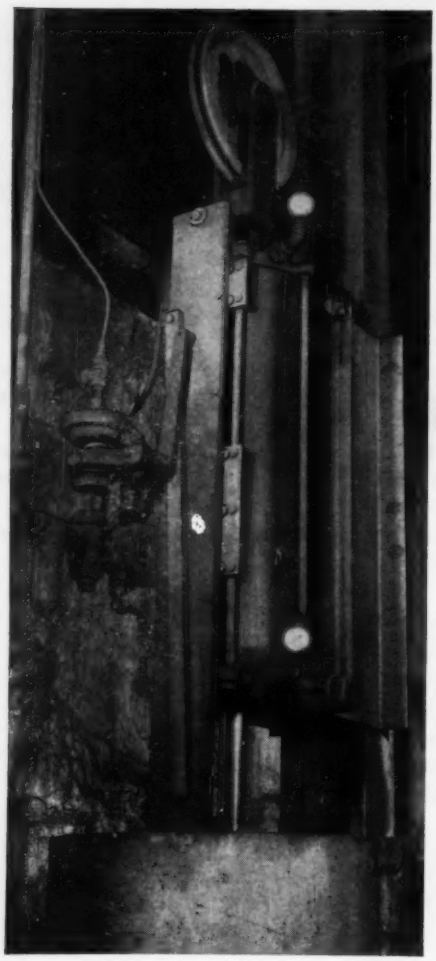
THE **hays** CORPORATION

MICHIGAN CITY 9, INDIANA

# MUSCLES

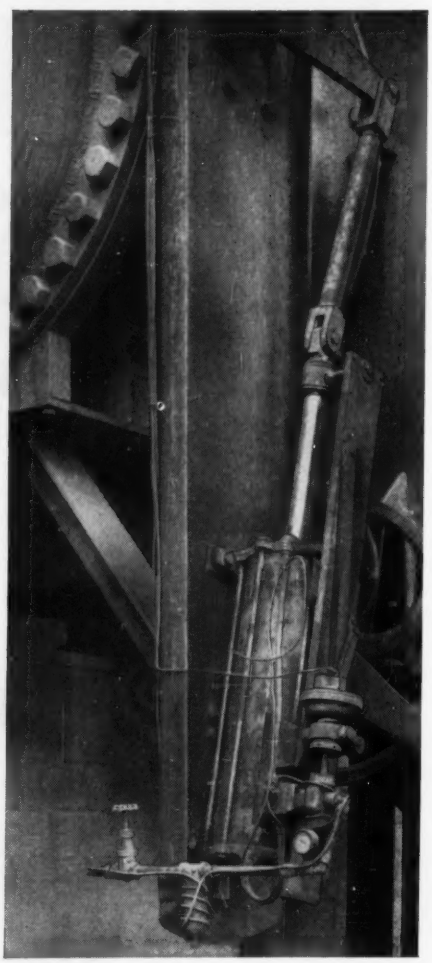
## HAGAN POWER POSITIONERS IN *FULL* RANGE OF SIZES!

6" x 10" Hagan Power Positioners operating inlet louvers to the forced draft fans for boilers of large power plant. (midwest climate)



10" x 30" counterweighted Hagan Power Positioner for 2500 pound slide type damper.

8" x 25" Hagan Power Positioner operating 54" butterfly valve, controlling flow of blast furnace gas to boiler. (Outdoor installation, note steam tracer lines)



# FOR INDUSTRY

Hagan Power Positioners are rendering dependable, accurate service under the most severe operating conditions. These rugged, double acting units assure plenty of power, and are meeting high standards of accuracy for valve, damper and lever operating applications.

Low piston leakage, low piston friction and modest cost make Hagan Precision Positioners an economical buy.

## CHECK THESE MANY OUTSTANDING FEATURES:

ACCURATE—piston takes a positive position for every incoming signal. Repeatability—1%.

HIGH SPEED—90% stroke in as little as 1.0 second.

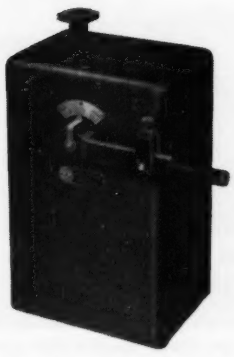
FLEXIBLE—positioning is normally linear with signal pressure, but any desired relationship may be obtained by shaping the feedback cam.

INPUT SIGNAL RANGES—complete selection of ranges—3-15, 0-30, 0-60; others available.

RUGGED CONSTRUCTION—insures dependable, long, trouble-free life.

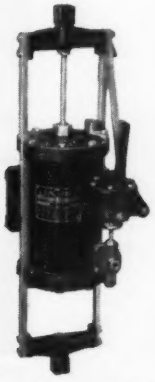
FULL RANGE OF SIZES—4″ to 12″ bore—5″ to 48″ stroke. Full power for any need.

ACCESSORIES—Manual Operators—piston air locks—limit switches and many others.



**4" x 5" HAGAN POWER POSITIONER**

Stall torque—400 lb ft.*
90% full stroke—1 sec.
Specification Sheet TP-245

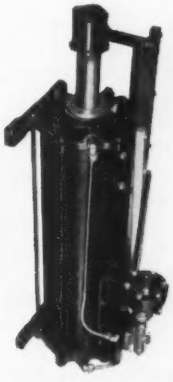


**5" x 10" HAGAN POWER POSITIONER**

Stall thrust—1950 lbs.*
90% full stroke—1.8 sec.
Specification Sheet TP-1510

**8" x 14" HAGAN POWER POSITIONER**

Stall torque—4600 lb ft.*
90% full stroke—2.5 sec.
Specification Sheet TP-2814



**12"x48"HAGAN POWER POSITIONER**

Stall thrust—11,000 lbs.*
90% full stroke—6 sec.
Specification Sheet TP1100

*With 100 psi power air

HAGAN HALL BUROMIN CALGON

## HAGAN CORPORATION

**HAGAN BUILDING • PITTSBURGH 30, PENNSYLVANIA**

Metallurgical Furnace Control Systems • Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Control Systems for Aeronautical and Automotive Testing Facilities

# NEW!

Porous stainless steel (15-diameter magnification)

# Cuno PORO-KLEAN filter stops 3-to 30-micron particles at 900°F

Cuno's new PORO-KLEAN offers true micronic filtration at temperatures that melt tin, bismuth, cadmium, lead or zinc.

High temperatures, high viscosity, high pressure drops and corrosive fluids don't faze this new filter.

**It's all metal**—absolutely lint-free. There's no contamination of the filtered fluid.

**It's strong.** PORO-KLEAN filters already in operation take a pressure drop of 1500 psi. PORO-KLEAN porous stainless steel has been used for structural parts in aircraft to achieve boundary layer control and transpiration cooling.

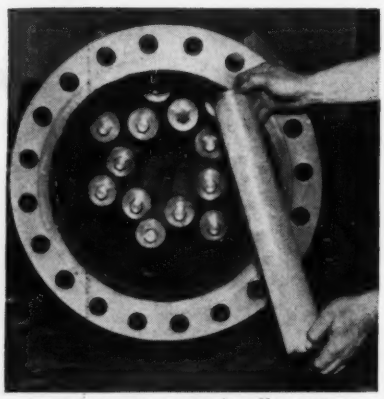
**It's corrosion resistant.** Standard in 316 stainless steel. Low carbon content (0.03 to 0.05% max.) prevents carbon precipitation at welds or during fabrication.

**It's easily cleaned**—in place, by backwashing with pre-filtered fluid or inert gas; or, when removed, with suitable solvent. May be sterilized with live steam for food or drug processing; or will filter rust and scale from steam used for other cleaning or sterilizing.

**Its porosity is closely controlled.** Four standard grades cover the range from 3- to 30-micron statistical particle retention.

**Standard designs.** For most applications standard housings and elements are available.

**Get all the facts** on Cuno's new PORO-KLEAN filter for your chemical or process applications. Write Cuno Engineering Corporation, 31-12 South Vine Street, Meriden, Conn. 5.3



**THIS PORO-KLEAN FILTER** handles 180 gpm of naphtha at 400°F. Operating pressure: 700 psi ASME Code with 5 psi pressure drop. It's cleaned by back-flushing with nitrogen. Cell-type PORO-KLEAN filter elements (large picture at top) have large surface area. This unit is 54" L x 9" O.D. and is designed for 1500 psi pressure drop and 550°F.

CUNO

## ENGINEERED FILTRATION

**Removes More Sizes of Solids From More Kinds of Fluids**

**AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)**

# Norton Products For The Atomic Program

Over half a century ago Norton Company first used electric furnace techniques to produce fusion-stabilized materials. Through the years Norton fusion-stabilized materials such as fused alumina, silicon and boron carbides, fused magnesia, zirconia, etc., have been made more valuable to industry and have been raised to new standards of quality, uniformity, and purity.

**Today, Norton keeps pace with the greatly increased demands of the atomic age for new high melting, chemically stable materials. In Cleveland in December, at the Atomic Exposition, a Norton exhibit will feature fusion-stabilized products and other products which have shown important potentialities for atomic energy applications:**

### *Reactor Components*

**Stable boron compounds for reactor control elements and neutron shields. Ceramic and powder-metal fabricated components for fuel element applications.**

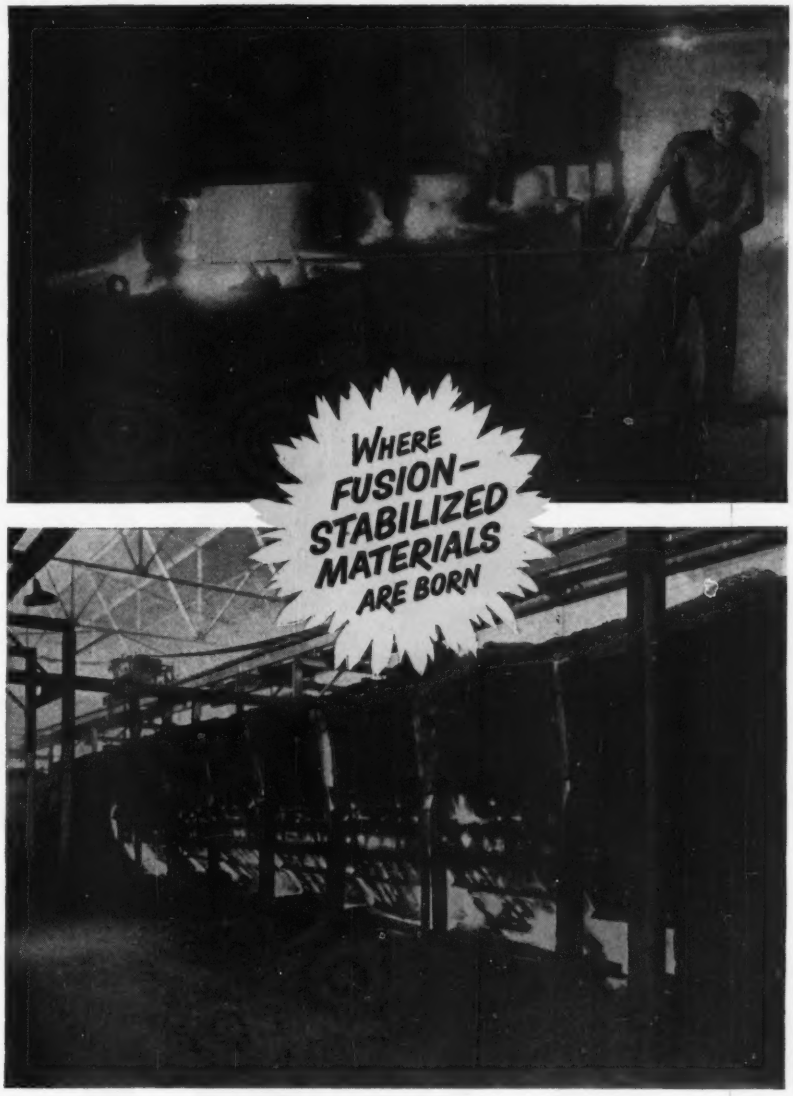
### *Special Refractories*

**High-purity ceramic shapes, including crucibles and furnace components for processing metals and fuel elements.**

### *Raw Materials*

**High-purity oxide, carbide, boride and nitride materials in granular and powdered form.**

In addition, Norton is presently developing numerous experimental items. The Norton research and development organization includes an engineering staff experienced in atomic development — available for cooperation where electric furnace products may be of interest.

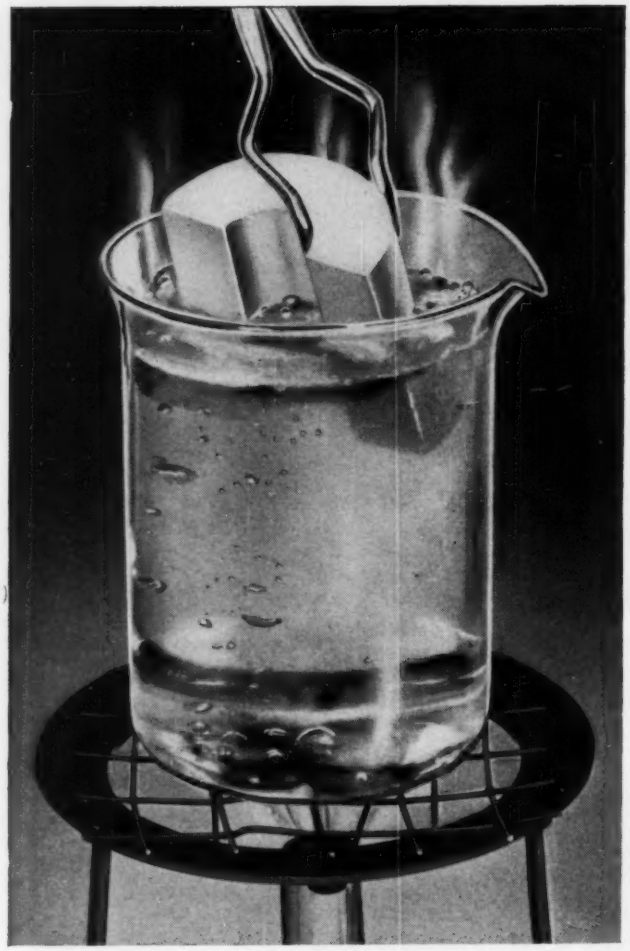



*Above:* Norton arc-type furnaces. *Below:* Norton resistance-type furnace.

Norton high-melting materials have varied applications in many fields. In particular, they are the basic ingredients of the famous Norton Refractory R's — refractories *engineered and prescribed* for the widest range of industrial uses. For further information write, mentioning your requirements, to NORTON COMPANY, Refractories Division, 511 New Bond Street, Worcester 6, Massachusetts.

NORTON
REFRACTORIES
*Engineered... Rx... Prescribed*
*Making better products... to make your products better*

# stability...



## just one of many reasons why KAYLO® is the king of high temperature insulations

Other high temperature insulations may look like Kaylo—but performance brings out the difference. Take stability, for instance.

Even when soaked in water for long periods, or immersed in boiling water, Kaylo (hydrous calcium silicate) not only refuses to break down but, after drying out, shows no apparent shrinking or warping! And its original thermal efficiency and exceptional strength return, too! Moreover, it can be removed and replaced for line inspection without waste.

No wonder Kaylo is called "king of high temperature insulations!"

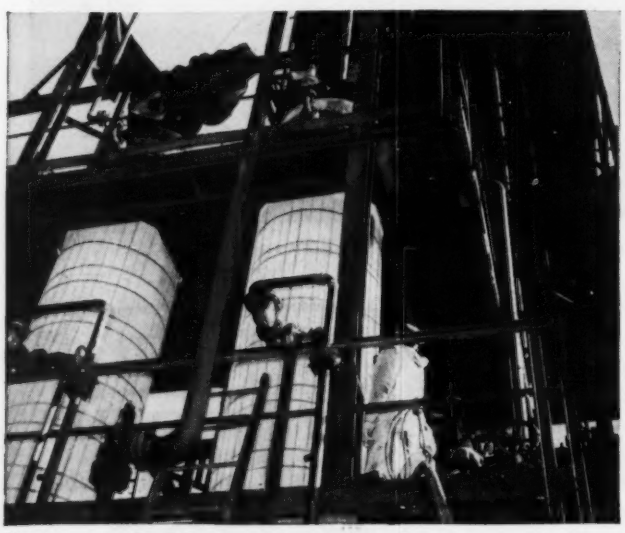
Together with Fiberglas*—the world's leading industrial insulation—Kaylo rounds out the most complete and versatile line of plant insulations available. It is distributed by Owens-Corning Fiberglas Corporation, and is made both as block and molded pipe insulation with the widest range of sizes, forms and thicknesses of any high temperature insulation.

*For complete technical data, see our listings in Sweet's File, Chemical Engineering Catalog, or Refinery Catalog. Or write: Owens-Corning Fiberglas Corp., Dept. 97-L, Toledo 1, Ohio.*

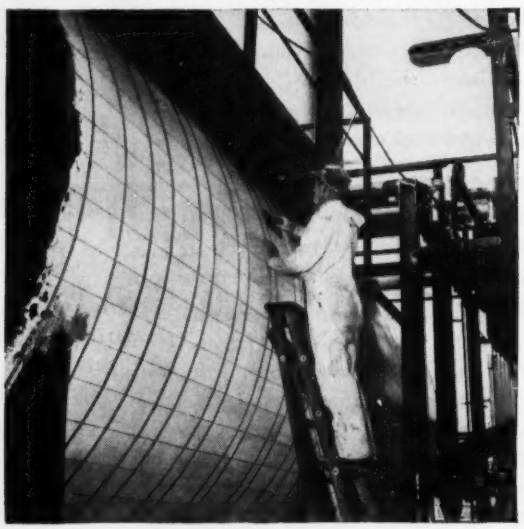
**Kaylo and Fiberglas now provide you with complete coverage from lowest sub-zero to 1200° F— from one reliable supplier.**

OWENS-CORNING
FIBERGLAS

* T. M. Reg. Owens-Corning Fiberglas Corporation
® Kaylo is mfd. by Owens-Illinois Glass Co., Inc.

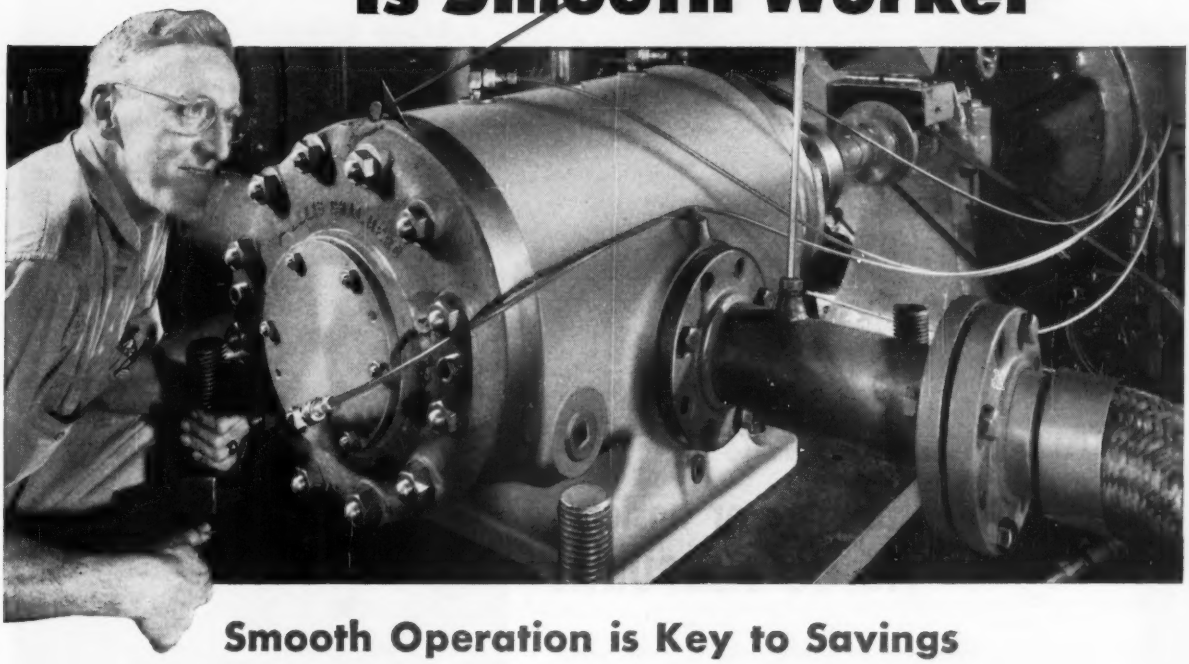


**Kaylo** on a pair of "strippers" in a fractionating plant, one of an increasing variety of industrial applications.



**Kaylo** block on desalter tank. Strength of material and large units mean more economical application, less waste.

# *Coin Trick Proves* RO-FLO COMPRESSOR Is Smooth Worker



## Smooth Operation is Key to Savings

Everybody around the place knew the *Ro-Flo* compressor was a smooth operator. But just how smooth?

Someone suggested the old coin trick . . . balance a coin on it while it's running.

The next we knew the foreman was calling, "Come down and see for yourself." We went to the shop. And sure enough, there the penny was standing as still as you please.

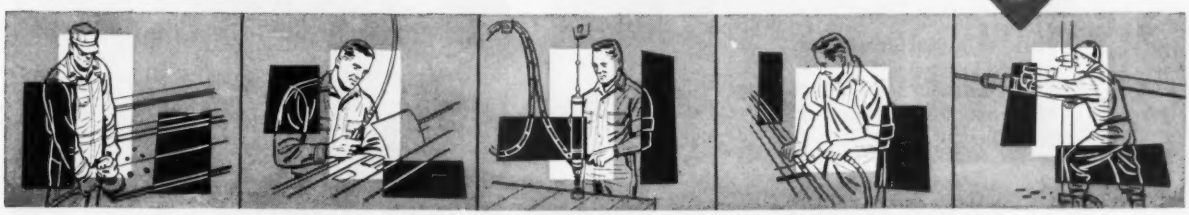
What does that mean to you?

It means, here's a compressor that needs practically no foundation. And it means there's no wear and tear from vibration...less maintenance.

You get constant air supply with this machine, too. For this story: Call your nearby A-C office for complete information, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. A-4716

*Ro-Flo* is an Allis-Chalmers trademark.

**ALLIS-CHALMERS** A-C ALLIS-CHALMERS

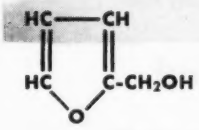


***Ro-Flo* compressors provide constant efficiency and air supply for air tools**

# QO® FURFURAL CHEMICALS

MORAN
...IN ALL THESE IMPORTANT USES
✓ SELECTIVE SOLVENTS
✓ CHEMICAL INTERMEDIATES
✓ EXTRACTIVE DISTILLATION
✓ RESIN FORMERS
✓ DYE DISPERSANTS
✓ PLASTICIZERS
✓ REACTIVE SOLVENTS
HC CH
HC C-CHO
O
Hawsers or hosiery via QO FURFURAL
Nylon hawsers, hosiery, lubricating oil, rosin, pharmaceuticals . . . These are just some of the products in which QO furfural proves its value.
For instance, over 40 petroleum refiners throughout the world use QO furfural as a highly selective solvent in refining lube oil and other petroleum fractions.
Resin manufacturers enjoy the benefits of long flow properties by modifying phenolic resins with QO furfural.
Abrasive wheel manufacturers use its solvent and wetting action in softening phenolic resin binders, and then react the furfural with the resin to form dense, super-hard wheels.
What has already been accomplished with QO furfural will be equaled or surpassed in the future. Keep posted with our helpful technical literature.
Furfural
Ask for Bulletin 204 describing the use of QO furfural.
Nylon marine hawser Photo Courtesy of Plymouth Cordage Company

# PROVE THEIR VALUE...EVERY DAY



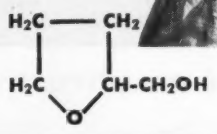
Corrosion-resistant valve is an example of the versatility of furfuryl alcohol resins. (Valve courtesy of Haveg Corporation.)

## QO FURFURYL ALCOHOL (FA®)

QO furfuryl alcohol is easily resinified when catalyzed by acidic reagents, and forms resins which are extremely resistant to attack by acids and solvents, and completely unaffected by alkalies—even hot concentrated solutions of NaOH.

Versatile FA dissolves many resins and reacts with some types to produce useful modifications. It improves the gap filling and craze resistant properties of urea adhesives, wets mineral surfaces, disperses many difficultly soluble substances, and acts as an important chemical intermediate.

Now is the time for you to investigate the profitable possibilities of QO furfuryl alcohol.



Polyvinyl rainwear made flexible through use of THFA.

## QO TETRAHYDROFURFURYL ALCOHOL (THFA®)

THFA is the starting point for many high-boiling esters and ethers. The 5-membered heterocyclic ring may be opened to form straight chain compounds, or expanded to a 6-membered ring, e.g., dihydropyran. Esterification proceeds smoothly with no special precautions.

Tetrahydrofurfuryl oleate is an important plasticizer, which contributes excellent low temperature flexibility to polyvinyl chloride films. It possesses excellent light and heat stability.

Brush and weed killers are formulated with tetrahydrofurfuryl esters of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). These esters feature low volatility and ready solubility in organic solvents.

As a solvent, THFA has complete water miscibility and a high boiling point. It quickly dissolves a great number of resins, gums, dyes and complex organic compounds, saving time and money in the process.

THFA is indeed worthy of your immediate consideration.

**FOR A BROAD SURVEY**

**BULLETIN 201-A** provides a comprehensive outline of QO Furan Chemicals.

**The Quaker Oats Company** CHEMICALS DEPT.

335D The Merchandise Mart, Chicago 54, Illinois
Room 535D, 120 Wall St., New York 5, N. Y.
Room 435D, Main P. O. Box 4376, Portland 8, Oregon

In the United Kingdom: Imperial Chemical Industries Ltd., Billingham, England
In Europe: Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France; A/S "Ota", Copenhagen, S. Denmark
In Australia: Swift & Company, Pty., Ltd., Sydney • In Japan: F. Kanematsu & Company Ltd., Tokyo

Wonder Drugs
Electronics
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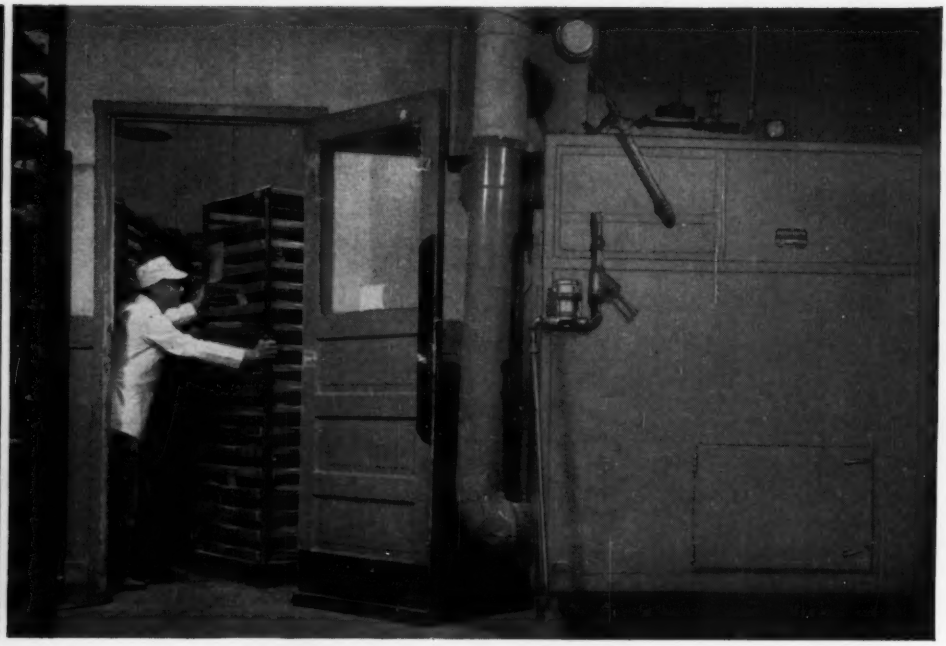

*This 19-year-old Lectrodryer still maintains 15% relative humidity here*

**Think of an ultra-modern process and you'll find**

# DEHUMIDIFICATION

**becoming a vital factor there**

ATMOSPHERES surrounding a material or entering into all of these processes must be DRY; dewpoints below −100°F. aren't unusual in our ultra-modern thinking. Raw materials feeding to a reaction may contain only a few parts of moisture per million. Such DRYness is brand new thinking to many engineers and scientists, but it's an old story to Lectrodryer* engineers.

Time was when refrigeration gave a dewpoint low enough for many operations. It's still a big help in catching that first moisture "off the top", but it takes a Lectrodryer to DRY air, gases and organic liquids to the low degree these ultra-modern processes demand.

Nineteen years ago the air-drying Lectrodryer shown here went to work at Strong Cobb & Company in Cleveland, maintaining 15% relative humidity in this tablet conditioning room. It has made that important operation independent of outside weather conditions ever since—a service duplicated in dozens of industries all over the world.

Lectrodryer engineers will help plan your installations to assure adequate, economical DRYing. Lectrodryers are, in most cases, ready to run when they reach your plant; simply set them in place, connect up steam or gas and power. These Type CH machines need almost no maintenance, since there is only a single, slowly revolving shaft.

The book, *Because Moisture Isn't Pink,* illustrates many of these DRYing jobs. For a free copy and other help, write Pittsburgh Lectrodryer Corp., 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

**LECTRODRYER**

* REGISTERED TRADEMARK U. S. PAT. OFF.

Toward
Tomorrow's
new world

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YOUR ENGINEERING PROBLEMS OF TODAY in chemicals, petrochemicals, metallurgy, atomic energy and petroleum...are met with CATALYTIC'S broad and diversified experience, imagination and skill – to give you better and more profitable products for tomorrow's new world.

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**CATALYTIC *ON-TIME...ON-BUDGET* SERVICES** for the metallurgical, chemical, petrochemical and oil refining industries
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# *It's the Nash!*

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintains 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

**No internal wearing parts.**

**No valves, pistons, or vanes.**

**No internal lubrication.**

**Low maintenance cost.**

**Saves floor space.**

**Desired delivery temperature Automatically maintained.**

**Slugs of liquid entering pump will do no harm.**

**75 pounds in a single stage.**

**NASH ENGINEERING COMPANY**

**312 WILSON, SO. NORWALK, CONN.**

DARCO Digest

CHEMICALS DIVISION
ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE
ATLAS POWDER COMPANY, CANADA, LTD., BRANTFORD, CANADA

# Efficiency of Adsorption Improved by Dividing Darco Dosage in Two Steps

A given amount of impurity can be adsorbed from solution with less activated carbon, if the carbon is applied in two successive portions instead of in a single dose.

This divided application, sometimes called split feed treatment, makes possible substantial savings in carbon consumption in purification processes. It is especially valuable in applications where the intermittent nature of production operations rules out the counter-current method of purification

The reason that divided treatment saves carbon is that it utilizes carbon at its greatest adsorptive efficiency. Adsorption follows a logarithmic law. The initial amount of impurity removed from a solution is comparatively easy to extract . . . but the final traces are more difficult to get, because the carbon has already spent most of its capacity. By dividing the required dosage into two parts, the first part of the carbon added is used to the full extent in taking out as much impurity as it can. Fresh carbon is then supplied for final clean-up.

The most efficient division of dosage (almost never 50:50) is derived from the adsorption isotherm, plotted on the Darcograph. The data obtained is applied to the dosage charts illustrated below.

The process is readily applied in production, as diagrammed above. If a holding tank of adequate capacity is available, only a single treatment tank and filter may be required.

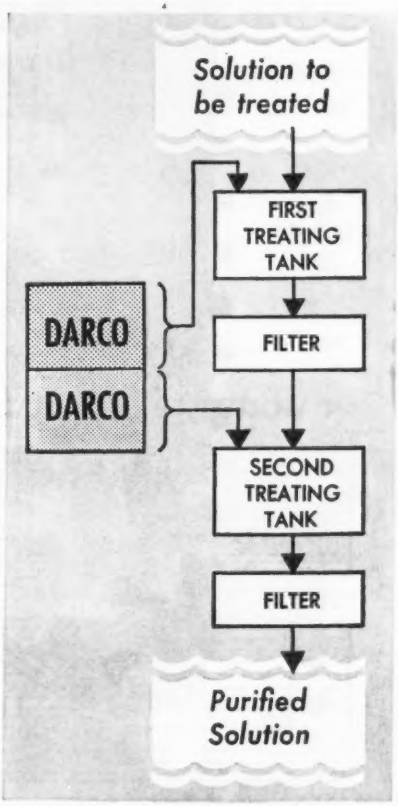
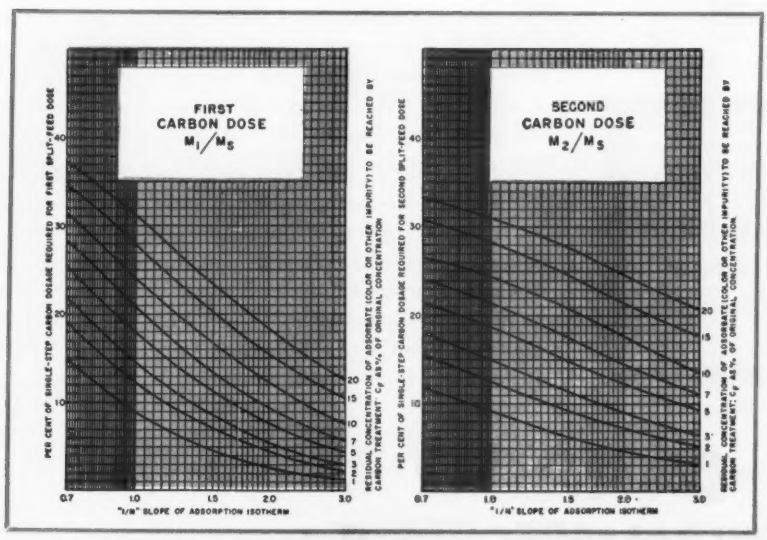
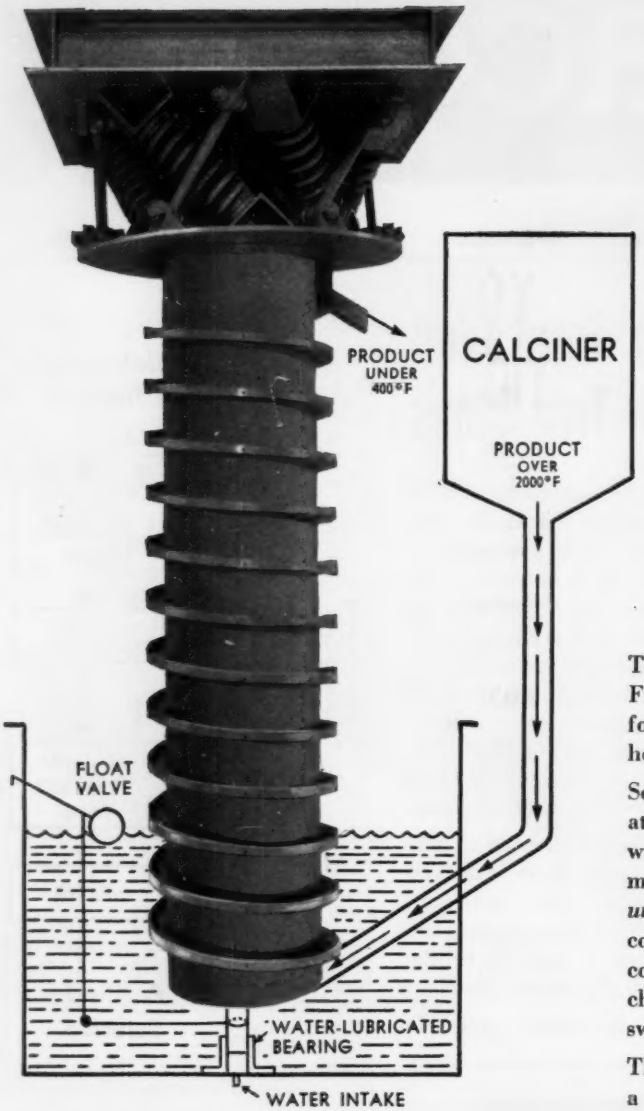



*Diagram of split-feed method of purification.*


FIRST CARBON DOSE $M_1/M_S$
SECOND CARBON DOSE $M_2/M_S$
PER CENT OF SINGLE-STEP CARBON DOSAGE REQUIRED FOR FIRST SPLIT-FEED DOSE
PER CENT OF SINGLE-STEP CARBON DOSAGE REQUIRED FOR SECOND SPLIT-FEED DOSE
RESIDUAL CONCENTRATION OF ADSORBATE (COLOR OR OTHER IMPURITY) TO BE REACHED BY CARBON TREATMENT: $C_f$ AS % OF ORIGINAL CONCENTRATION
"1/n" SLOPE OF ADSORPTION ISOTHERM

*Darco dosages for split-feed process can be determined from these charts, included in our new booklet.*

If you are now using activated carbon in a single-step treatment, split feeding may save you a worthwhile percentage of your carbon cost. Our new booklet outlines the basic principles of this method and presents charts useful in calculating the dosages required. Write for a copy of "Two Step Divided Applications of Darco" . . . and let Darco's technical staff give you assistance on your specific application.




# HERE'S DEPENDABLE HEAT-TREATING AND QUENCHING!

This 8-ft. high "spiral ramp" is a Carrier Natural-Frequency Vibrating Conveyor—especially designed for uniform, dependable, continuous quenching on hot chemical catalysts.

See how it works. The chemicals leave the calciner at over 2000°F and are transferred three feet under water onto the bottom spiral of the conveyor. The materials are then agitated and vibrated upward, *uniformly*. They reach the top two minutes later, completely dry, at 400°F. The materials move at a constant speed. The operator can control the discharge temperature *exactly*, by adjusting the float switch to provide either more or less immersion time.

The unit is stainless steel throughout, is powered by a ¾ H.P. drive, and has a capacity of 2400 lbs. per hour. It's been "on the job" for over two and a half years—has paid for itself many times over in lowered maintenance costs and increased production!

What are your heat-treating or quenching problems? If they're at all similar—or if they involve bleaching, washing or any other operation where an agitated condition between materials and liquid must be uniformly maintained, Carrier Natural-Frequency equipment will do a better job—*and save you money, to boot!* Write Carrier Conveyor Corporation, 259 N. Jackson St., Louisville 2, Kentucky.

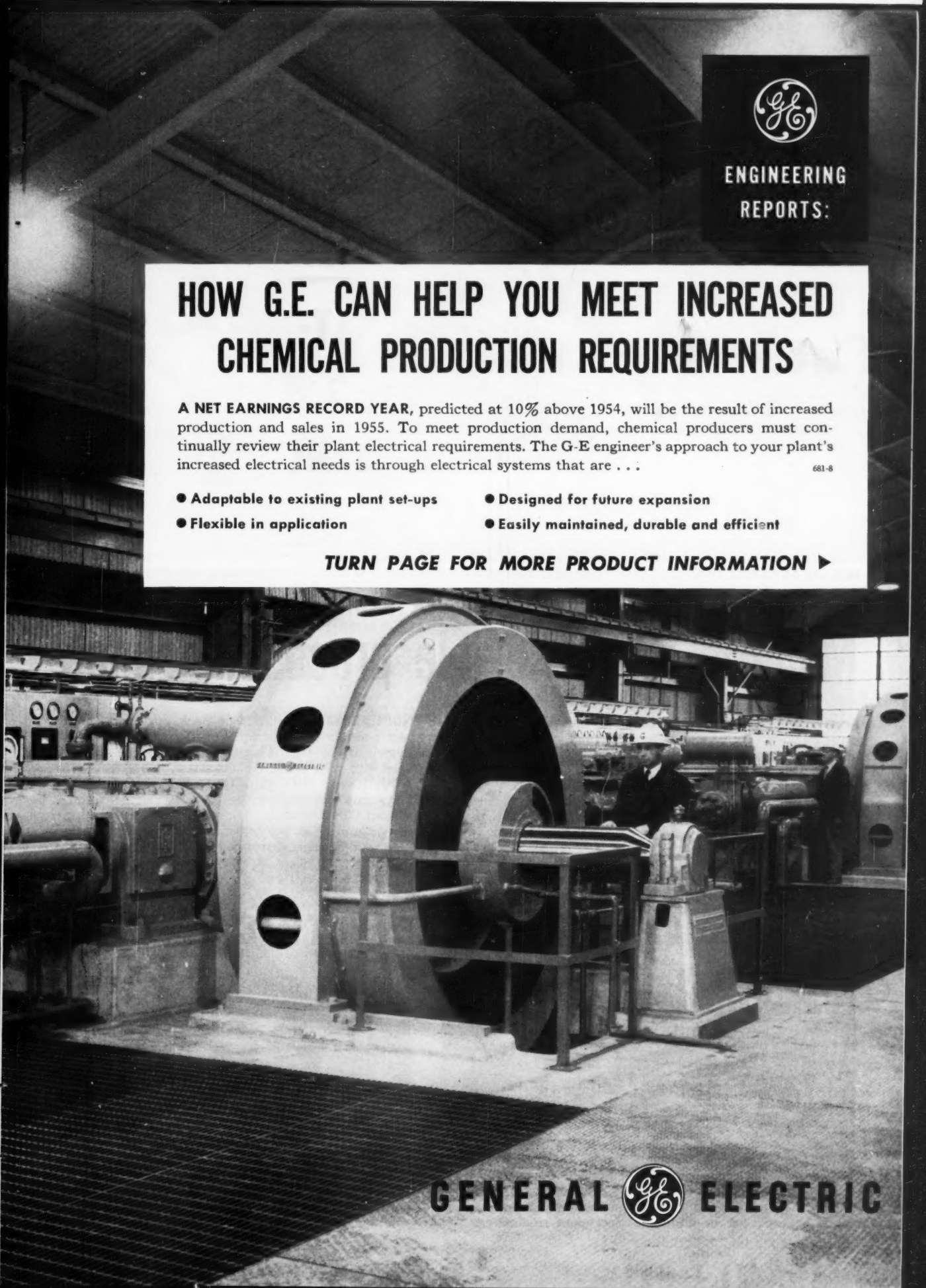
The Natural-Frequency principle is always used in Carrier Conveyors and other Vibrating Equipment. It accounts for the magic Carrier formula:

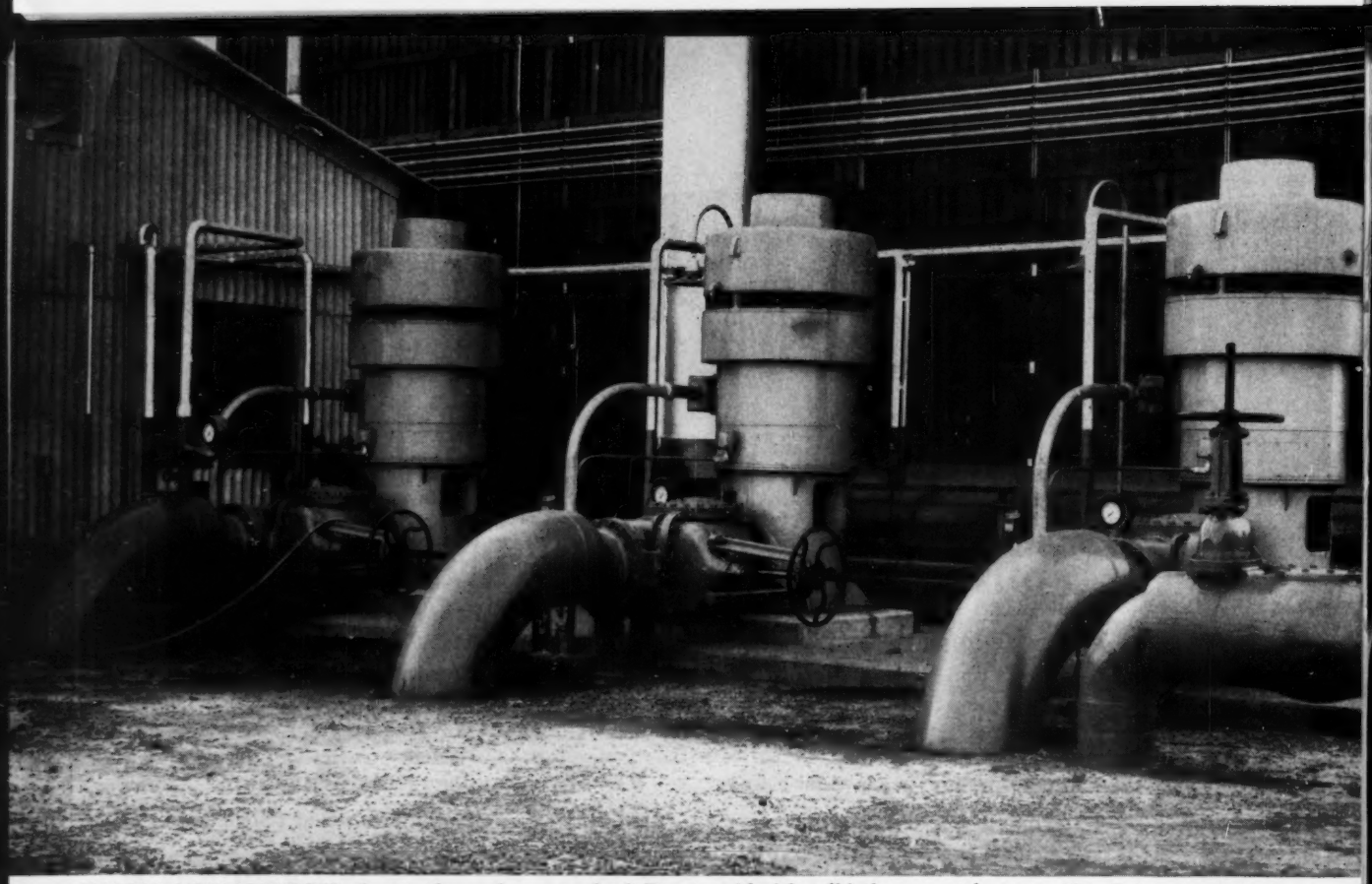
**LOW HORSEPOWER means LOW OPERATING STRESS**

**LOW OPERATING STRESS means LOW MAINTENANCE**

**LOW MAINTENANCE means EFFICIENT, UNINTERRUPTED PRODUCTION**

# CARRIER NATURAL-FREQUENCY CONVEYORS


ENGINEERING
REPORTS:
HOW G.E. CAN HELP YOU MEET INCREASED CHEMICAL PRODUCTION REQUIREMENTS
A NET EARNINGS RECORD YEAR, predicted at 10% above 1954, will be the result of increased production and sales in 1955. To meet production demand, chemical producers must continually review their plant electrical requirements. The G-E engineer's approach to your plant's increased electrical needs is through electrical systems that are . . .
681-8
● Adaptable to existing plant set-ups
● Flexible in application
● Designed for future expansion
● Easily maintained, durable and efficient
TURN PAGE FOR MORE PRODUCT INFORMATION ▶
GENERAL ELECTRIC



**SEVERAL AVAILABLE TYPES** of protective enclosures make G-E motors ideal for all indoor or outdoor uses. New Polyex insulation

## *G-E ENGINEERED DRIVES AND POWER SYSTEMS MEAN . . .*

# Modern, more flexible processing lines

**IN THE NEXT TEN YEARS,** production must increase an estimated 50% to meet greater consumer needs. Available manpower will increase only an estimated 14% during the same period.

**INCREASED OUTPUT AND EFFICIENCY** must close the production gap between available manpower and estimated demand. General Electric electrical systems are designed and installed for efficient, flexible, easily expanded production.

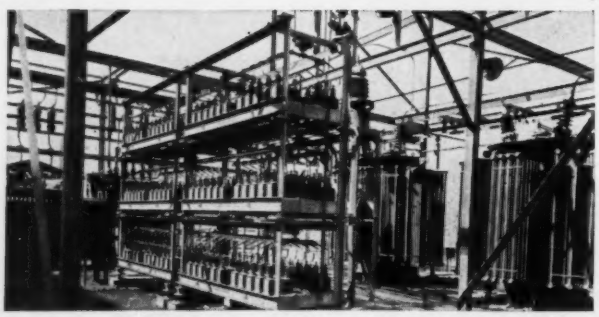
**G-E ENGINEERING SERVICES** (see back page) can help you meet production requirements to bring your electrical system up to date. The result is a modern system integrated into your present plant setup.

**FOR ADDITIONAL INFORMATION** on how G-E engineered systems and engineering services can help you, contact your G-E Apparatus Sales Representative during your early planning at the nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

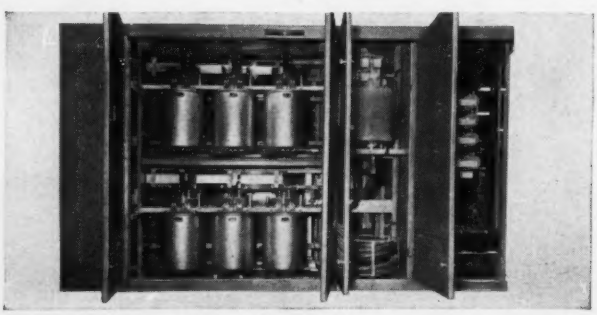
681-5

**Engineered Electrical Systems for Process Industries**

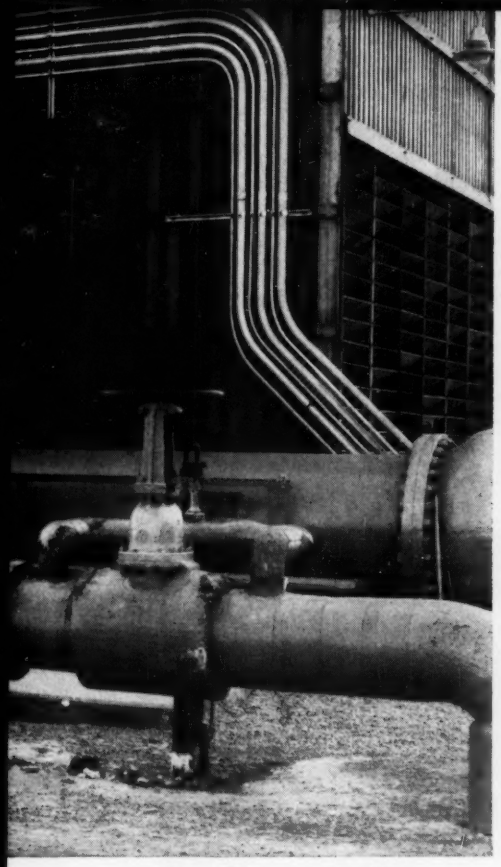
**GENERAL ELECTRIC**



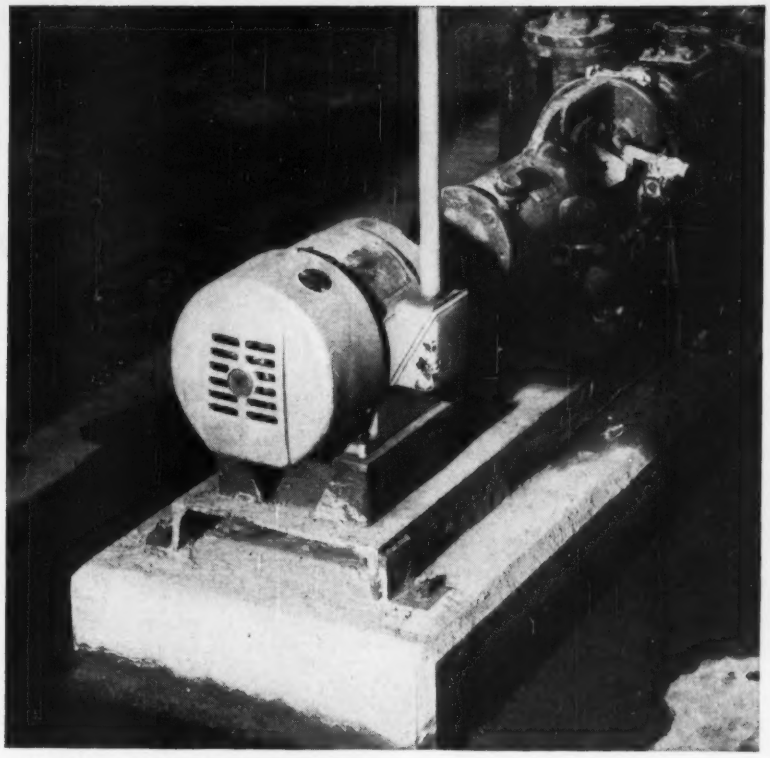
**"BUILDING-BLOCK"** design of this stack-rack capacitor block reduces installation costs. This design means equipment may easily be expanded or moved to meet plant requirements.



**HIGH EFFICIENCY** and low installation cost of this pumpless rectifier provide more reliable and economical d-c power. Factory wired, the unit is ready when it arrives to connect and operate.



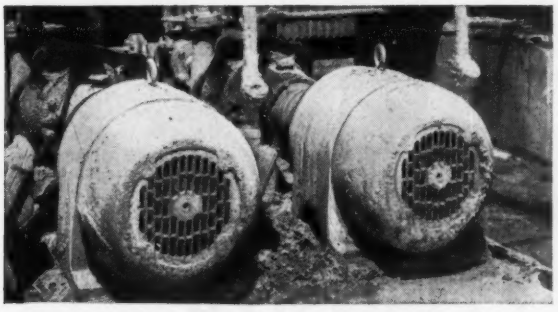
gives up to 50% longer motor life.



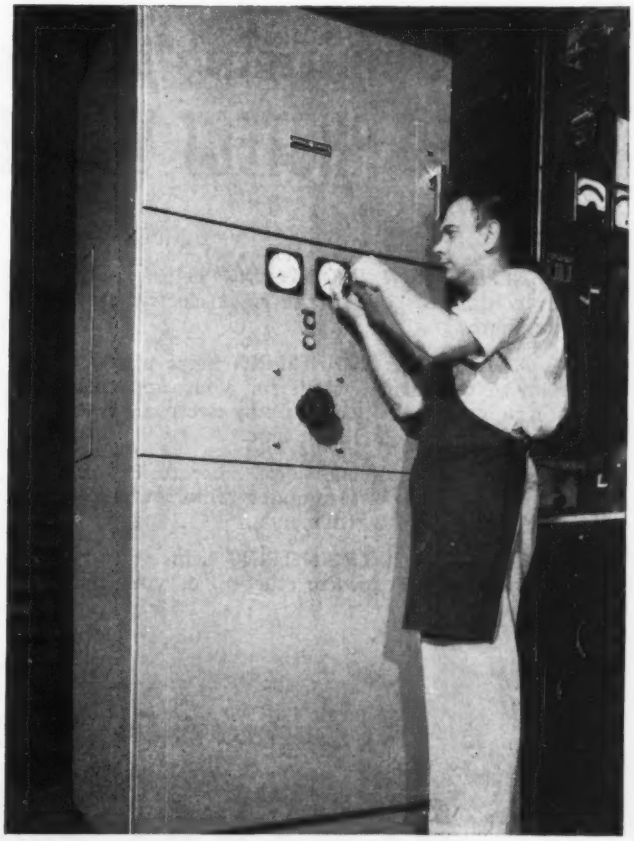
**NEW G-E TRI-CLAD* '55' MOTORS,** totally enclosed, are suitable for damp areas, even where hosing is necessary. New cooling system cleans while it cools motor.

# for your plant

**G-E MAGNETIC STARTERS** and safety switches are compact, for maximum space savings. Short-circuit protection is provided by circuit breaker or fusible disconnect switch.



**CORROSIVE ATMOSPHERE** effects are greatly minimized in these G-E Tri-Clad induction motors. Rugged cast-iron construction makes them excellent for process application.



**SHORT CIRCUIT PROTECTION** up to 60,000 amps, plus 50% greater space savings are provided by all-new G-E Limitamp*.

*Reg. Trademark of General Electric Company

## SIX G-E ENGINEERING SERVICES . . .

# HELP YOU PROTECT YOUR EQUIPMENT INVESTMENT

1 **G-E APPLICATION ENGINEERING** helps you and your consultants design the right electric system for your plant.

2 **G-E ANALYTICAL ENGINEERING** helps attain the optimum electrical system for your application. Engineering experience backed up by electronic system analyzers save valuable design time.

3 **G-E PRODUCT DEVELOPMENT** laboratories design and test new equipment under tomorrow's conditions to meet your future demands.

4 **G-E FIELD-SERVICE ENGINEERING** helps you supervise installation, expedite start-up of your major electric equipment.

5 **G-E MAINTENANCE SERVICE** from 36 G-E Service Shops will repair and uprate your old equipment, help establish productive maintenance of your equipment, furnish emergency service.

6 **G-E PROJECT CO-ORDINATION** means on-time engineering, shipment, installation of your electric equipment from preliminary diagrams through start-up.

These valuable services are available to you with General Electric equipment. Contact any General Electric Apparatus Sales Office. Meanwhile, for the full story of G-E engineering services, write for brochure GED-2244, General Electric Co., Section 681-5, Schenectady 5, N. Y.

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

*You get more than a cutter at*
**SPROUT-WALDRON**

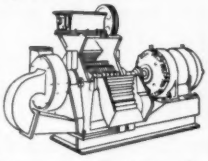
You get many *plus* values when you deal with Sprout-Waldron. In cutters and other size reduction equipment, you get a wide choice of styles and sizes. And each model can be tailored to fit your needs by Sprout-Waldron's unusual "adaptioneering" methods.

Ray Whitcomb

You also get reliable guidance on installations and applications from our engineering representatives and engineering staff. Their recommendations are based on long experience and backed by case history files of successful processing applications and laboratory tests.

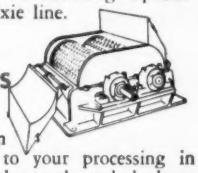
A typical Sprout-Waldron sales engineer is Ray Whitcomb, pictured here. Before coming to Sprout-Waldron five years ago, Ray sold mixing, size reduction, and materials handling equipment for two smaller manufacturers of processing equipment. His ability to analyze difficult processing problems and to suggest solutions has made him valuable to the customers he serves. With such men to help you, you're bound to buy *right* at Sprout-Waldron.

**HAMMER MILLS**



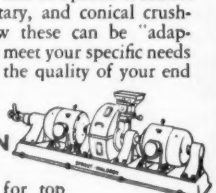
With the recent acquisition of the patents and facilities of Dixie Machinery Company, one of the finest hammer mill plants in the U. S., Sprout-Waldron now offers a line of great diversity and high quality. Before buying *any* hammer mill, check the outstanding Sprout-Waldron-Dixie line.

**CRUSHERS**



Crushing can be applied to your processing in many unusual ways through the large and versatile line of Sprout-Waldron sawtooth, rotary, and conical crushers. Ask how these can be "adaptioneered" to meet your specific needs and improve the quality of your end products.

**ATTRITION MILLS**



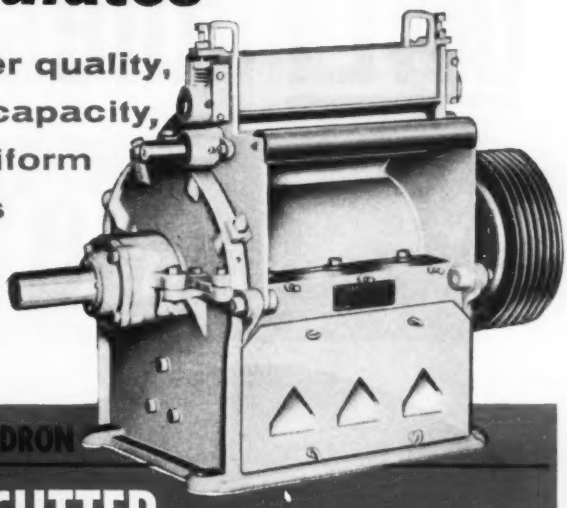
Long noted for top performance under continuous heavy-duty conditions, Sprout-Waldron attrition mills may solve your problems of rubbing, cutting, crushing, or tearing. Available with horsepowers ranging from 3 to 500 and a selection of hundreds of different disc-surface designs. Ask for details.

ALSO Sprout-Waldron offers complete lines of roller mills and burr stone mills to help solve your size reduction problems.

SPROUT·WALDRON SW

# Cuts...Flocks... Granulates

**for higher quality, greater capacity, more uniform products**



**SPROUT-WALDRON KNIFE CUTTER** ...with optional feed rolls

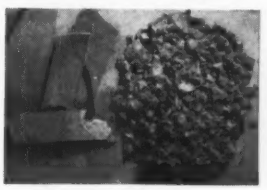
A unique arrangement of knives and screens produces clean, uniform product particles and greater capacity with a reduction in customary frictional heat. Great versatility is obtained by varying the feed arrangements, rotor types, knife clearances, and screen perforations.

The Sprout-Waldron PC-103 Knife Cutter performs such widely different jobs as pre-cutting rags or leather for subsequent defiberizing . . . flocking continuous strips of alpha pulp . . . and granulating cork or thermoplastic stock.

It can be adapted to meet individual needs through Sprout-Waldron "adaptioneering" methods. Write for full details.

**FLOCK:** 60 mesh flock from sulphite pulp sheet.

**GEON PLASTIC:** 5-20 mesh granules from 1/8" sheet cut through 5/16" screen.



**LEATHER:** Leather scrap through ½" screen.

**SPROUT-WALDRON**

*Manufacturing Engineers Since 1866*

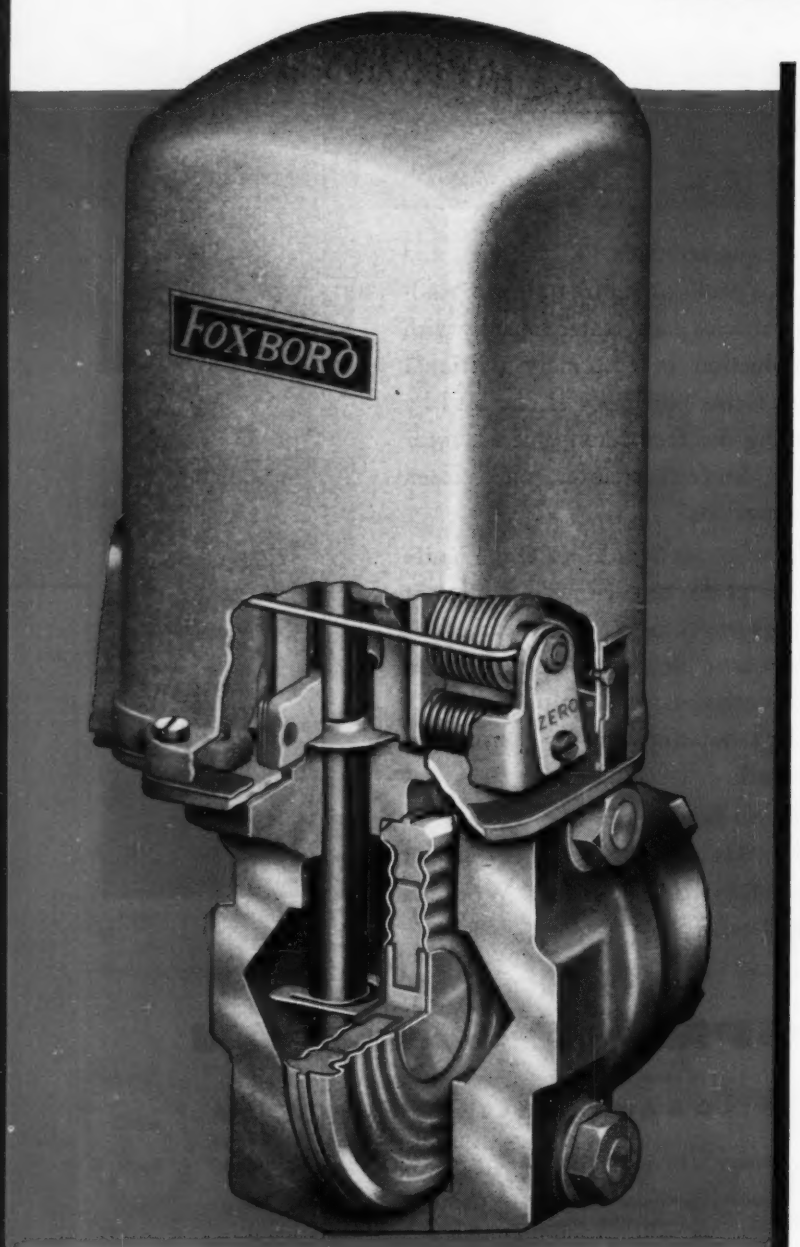
**15 LOGAN STREET • MUNCY, PA.**

*Equipment for* { SIZE REDUCTION, MIXING & BLENDING, PELLETING & CUBING, BULK MATERIALS HANDLING, PRODUCT CLASSIFICATION

*Facilities for* **fabricating, machining, custom founding, woodworking, laboratory testing**

393

# ONLY the Type 13A d/p has these 6 advanced-




- **Positive Overrange Protection** up to full 1500 lb. rating
- **Fully Adjustable Ranges . . .** 0-20" to 0-80" and 0-50" to 0-250" $H_2O$ differential
- **Automatic Internal Damping** . . . fast, *stable* measurement
- **Simplicity** . . . easiest, lowest cost installation, least maintenance
- **Convenient Zero Adjustment** . . . external — no need to remove weatherproof cover
- **Highest Sustained Accuracy** . . . even under extreme operating and ambient conditions

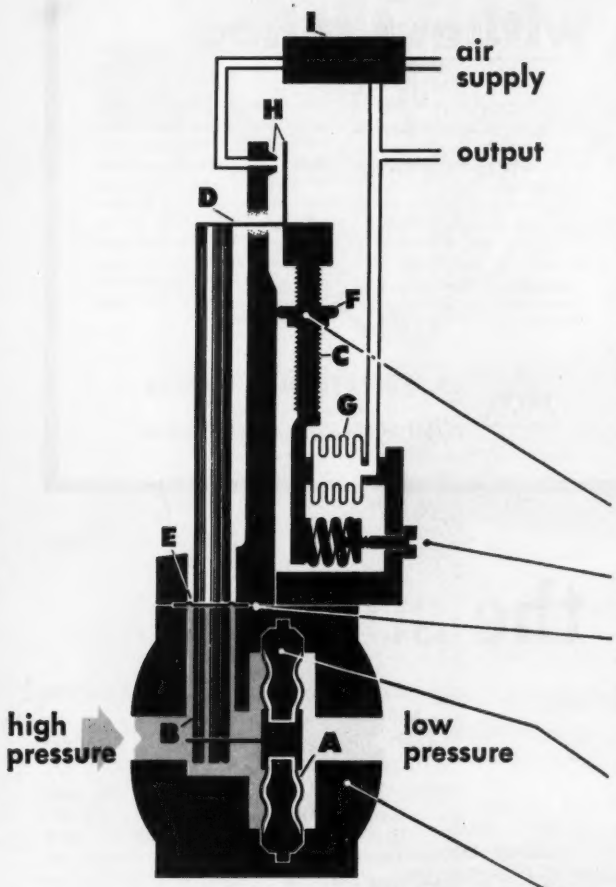
With these basic features, plus many other technical refinements throughout, the new Type 13A d/p Cell* Transmitter surpasses all previous records in performance . . . economy . . . convenience. For the complete story and a demonstration, call your nearest Foxboro representative. Write for new Bulletin 13-11. **The Foxboro Company, 3612 Neponset Ave., Foxboro, Mass., U.S.A.** Factories in the United States, Canada and England.

*Reg. U. S. Pat. Off.

**More Foxboro flow transmitters are in use by the process industries than all other makes combined!**

# Cell Flow Transmitter

# design features...




## How It Works . . .

An increase in differential pressure across Twin-Diaphragm Capsule (A) exerts force to right on force bar (B). Elgiloy® diaphragm seal (E) acts as fulcrum. Force to left at top of bar (B) causes flapper to approach nozzle at (H). Resulting increase in nozzle pressure is amplified by relay (I). This pressure is sent to feedback bellows (G) which develops force to counterbalance the differential pressure on capsule (A). The 3-15 psi output signal from relay (I), always precisely proportional to differential pressure, is transmitted to remote recording or controlling instrument.

**Range Wheel is continuously and easily adjustable for entire range whether 0-20" to 0-80" or 0-50" to 0-250" $H_2O$.**

**Easy-access screw adjustment permits field "zeroing" without removing weatherproof cover.**

**Elgiloy® stainless alloy diaphragm seal assures a corrosion-resistant, frictionless, positive pivot point. Instrument is constructed in 3 basic units — body, transmitter, and air relay block — eliminating all possibility of errors produced by piping stresses.**

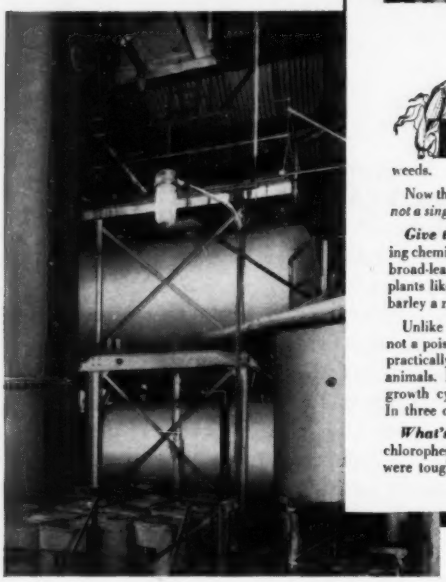
**Silicone-filled Twin-Diaphragm Capsule filters out flow disturbances ("noise") at measurement source . . . without loss of speed of response. Precisely matched surfaces of diaphragms and capsule core provide "stops" which give positive overrange protection in both directions.**

**Rugged forged body, optionally Type 316 S.S. or carbon steel, gives greatest strength with least weight . . . ultra-compact design permits low cost mounting from flange taps.**

FOXBORO
Reg. U.S. Pat. Off.

*First in Flow Instrumentation*

**Purity is safeguarded.** Under- and over-chlorinated portions are separated from 2,4-D in this equipment. To maintain purity, fractionating column is solid nickel. Tanks are Nickel-Clad Steel. Both materials are also used in other equipment for the same purpose.



# Man without a hoe

*This cornfield* once looked hopelessly over-grown with weeds.

Now the weeds are under control. *Yet not a single hoe ever touched the soil.*

***Give the credit*** to 2,4-D, an amazing chemical discovery. It destroys only broad-leaved weeds. And gives food plants like corn, wheat, rice, oats and barley a new lease on life!

Unlike older weed killers, 2,4-D is not a poison in the accepted sense. It's practically harmless to humans or animals. But it disrupts the normal growth cycle of broad-leaved weeds. In three or four weeks, they're *dead.*

***What's 2,4-D?*** Actually, 2,4-dichlorophenoxyacetic acid. And there were tough problems to overcome at nearly every stage of its development.

Corrosion, for example, was a constant threat to the life of equipment — and to the purity of the final product. So nickel and the nickel alloy, Monel®, are specified for pipes and fittings, steam coils, reactors, centrifuges, dryers, tanks and other equipment used in the making and handling of 2,4-D.

***Nickel and Monel*** protect product purity. And they resist corrosion as few metals do!

If you have a problem in which corrosion, high or low temperatures, stresses, fatigue, or the maintenance of product purity are troublesome factors, let's talk it over. Two minds are always better than one, and we may be able to help you find out how nickel — or one of the more than fifty Inco Nickel Alloys now available — can solve *your* probem. Write The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

INCO TRADE MARK

**INTERNATIONAL NICKEL**

67 Wall Street New York 5, N. Y.

***Nickel Alloys Perform Better Longer***

# Story behind the story...

## *Nickel and Monel hold corrosion down, give chlorinated organic high purity*

If you chlorinate organics, you may find the story behind this Business Week advertisement (Sept. 24 issue) of particular interest.

When Pittsburgh Coke & Chemical Company began to make the now-famous weed-killer, 2,4-D, a number of years ago, some formidable corrosion and contamination problems soon developed.

During the chlorination, small amounts of hydrochloric acid form and some chlorine fails to react. Both corrosives are bad for equipment. Worse for product . . . since even a little metallic pick-up adversely affects its color and purity.

### Corrosion tests showed what to do

Eventually, nickel or Nickel-Clad Steel replaced other materials in the still, steam coils, fractionating tower, condenser and storage vessels.

Monel*, an Inco nickel-copper alloy, is now used for the 2,4-D reactor, the dichlorophenol weighing tank, the stripping column, the centrifuge and dryer.

The result? Practically trouble-free operation.

If you have a corrosion or contamination problem, Inco Nickel, Monel, or other nickel alloys may prove the answer. Inco's Corrosion Engineering Section will be glad to help you look into it. Just write.

*Registered Trademark

**THE INTERNATIONAL NICKEL COMPANY, INC.**

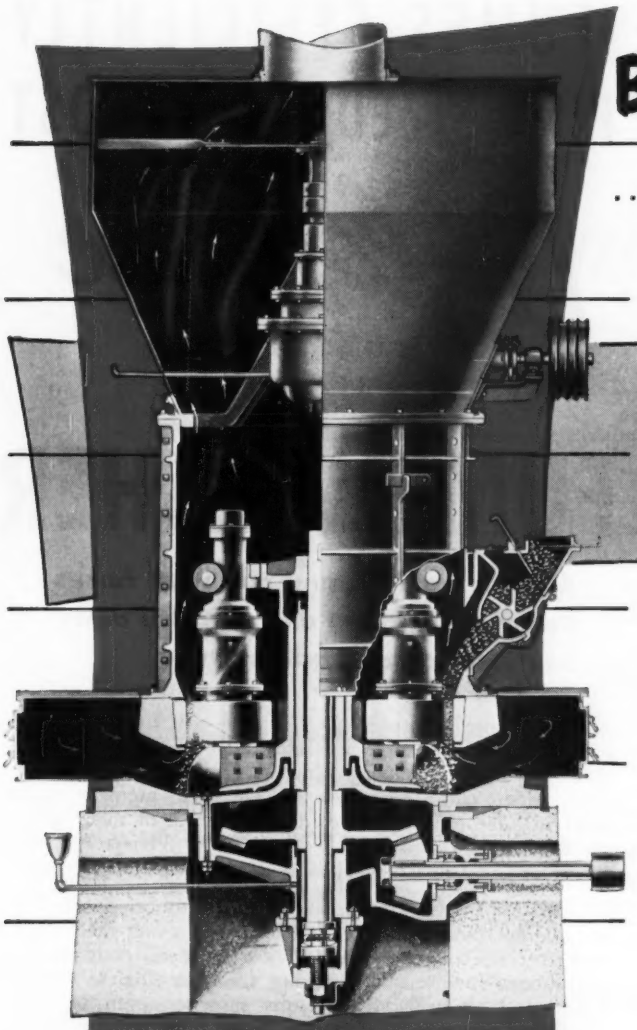
67 Wall Street New York 5, N. Y.

INCO TRADE MARK

MONEL* • "R"* MONEL • "K"* MONEL • "KR"* MONEL • "S"* MONEL • INCONEL* • INCONEL "X"* • INCONEL "W"* • INCOLOY* • NI-O-NEL • NIMONIC* ALLOYS • NICKEL • LOW CARBON NICKEL • DURANICKEL*

# Better Fine Grinding...

...How to improve accuracy, uniformity and output at reduced cost



Cross section of Roller Mill showing how material is ground by rolls rotating against bull ring, then air swept to separator which extracts fines and returns coarse material to mill for regrinding.

## WILLIAMS *Roller Mills*

Positive and continuous precision size control at exceptionally high production rates are only two of the superior features of Williams Roller Mills. Instant adjustment for grinding from 20 mesh down to 400 mesh, even to micron sizes, has established the Williams as one of the most versatile of fine grinding mills. Finished products can be maintained at finenesses of 99.9% + passing 325 mesh.

The operation of a Williams Roller Mill is simple, yet performance remains unsurpassed. Positive, self-adjusting feeding and blending of raw materials into the mill is automatic where pulverizing is done by grinding rolls spinning centrifugally against a bull ring. A continual rising current of cool air sweeps upward carrying ground material to the classifier that separates all finished fines from the coarse tailings which are all returned for further grinding.

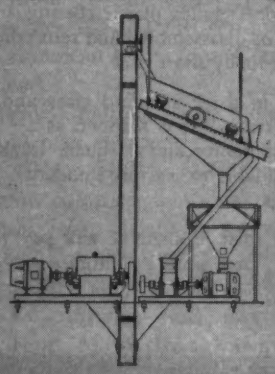
Rugged construction promises less down time, lower power costs, minimum maintenance. Automatic take-up for wear is continuous.

Find out how easy it is to improve product quality and reduce production costs. Get all the facts about Williams Roller Mills.

*Write today for literature.*

***TESTING AND RESEARCH LABORATORIES** are at your service to help you solve every size reduction problem. Write for information.*

**WILLIAMS PATENT CRUSHER & PULVERIZER CO.**
**2706 N. 9th St. St. Louis 6, Mo.**



**WILLIAMS COMPLETE PLANTS**

Williams builds all types of ready-to-install plants for crushing, grinding and air separation, including storage bins and electrical equipment. Consult the industry's most experienced engineers. Write!

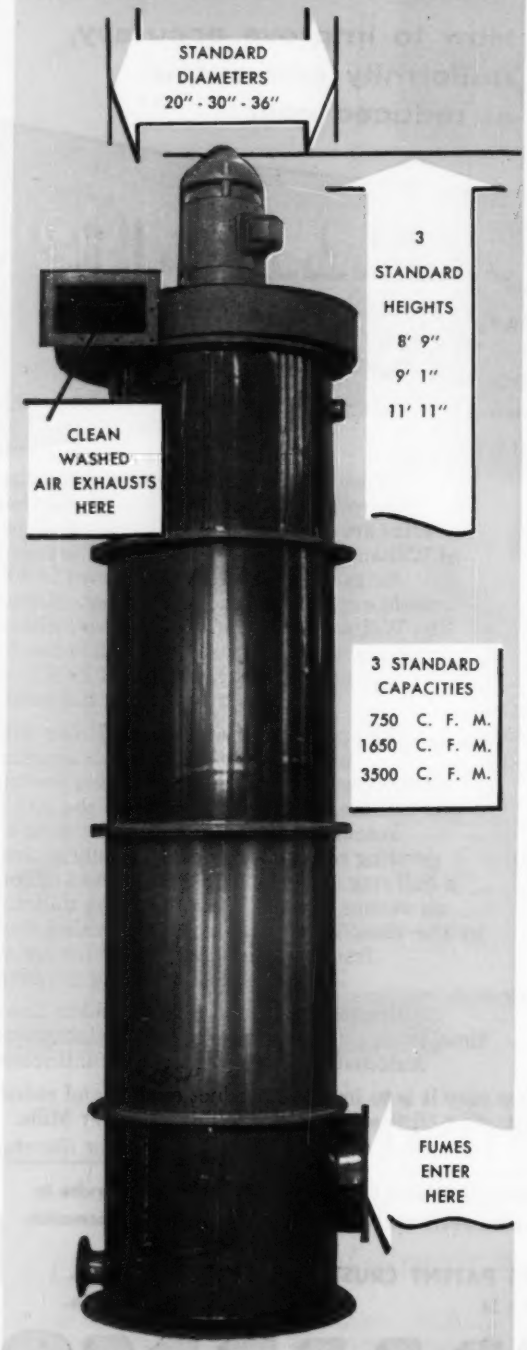
# WILLIAMS

CRUSHERS GRINDERS SHREDDERS

Hammer Mills Helix-Seal Mills Air Separators Vibrating Screens Feeders Impactors

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

# NOW, CORROSIVE FUMES EFFICIENTLY REMOVED BY NEW "PINT SIZED," LOW COST


STANDARD DIAMETERS 20" - 30" - 36"
3 STANDARD HEIGHTS 8' 9" 9' 1" 11' 11"
CLEAN WASHED AIR EXHAUSTS HERE
3 STANDARD CAPACITIES 750 C. F. M. 1650 C. F. M. 3500 C. F. M.
FUMES ENTER HERE

# Cyclonaire

PORTABLE

# FUME WASHER

***Absorbs noxious and corrosive fumes***
***Removes irritating and abrasive dusts***
***Supresses oil and acid mists***

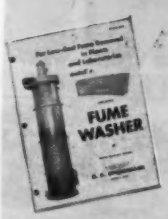
The Cyclonaire is surprisingly compact—will fit almost anywhere, but it does a big fume removal job formerly possible only with expensive custom-designed units. It will safely handle corrosives in low concentrations normally encountered in fume scrubbing operations. Removal of many gases (of 1% concentration or less)—is up to 99.9% effective. Low power requirements make it very economical to operate.

In operation the Cyclonaire is a wet bed scrubber—with an all important difference. Instead of designing the unit first, then selecting a packing . . . our engineers designed the unit around Intalox saddle packing, the most efficient industrial tower packing made. The results surprised even us. We discovered that it is possible to do a big fume removal job with a small fume washer . . . when packed with Intalox!

The Cyclonaire is constructed of steel in easy-to-assemble flanged sections, secured by split ring clamps (the 36" size is bolted). All inner and outer surfaces are protected by an inert Tygon or Tygoflex plastic coating. It can be assembled in a few hours, or disassembled and reinstalled in a different location in an equally short time.

The Cyclonaire is available in three standard sizes and three capacities. (See illustration.) It is shipped as a "package" unit complete with motor and adequate Intalox packing. Special parts are available to convert standard units for unusual applications.

If you have a fume, dust or mist problem it will pay you to look into the low cost . . . pint sized . . . high efficiency Cyclonaire.




*Get all the facts...*

**Send today for Bulletin FW-4. Get the complete story on this modern money saving, space saving method of fume elimination.**

**PROCESS EQUIPMENT DIVISION**

**U. S. STONEWARE**

**AKRON 9, OHIO**

135E

DECEMBER
1955

# Chementator

*Edward T. Thompson*

**• Molten lithium is now being considered as a ship propellent by the Navy. Push would come from reacting the metal with seawater.**

**• Neither firm will admit it, but Rohm & Haas will soon boost capacity at Houston for acrylic raw materials and Air Reduction is poised for a multimillion dollar plunge into petrochemicals.**

## Improved cement process looms

Cement makers are watching with unconcealed interest the advent of a new double-pass preheat system that promises big heat economies, high cleanliness and very small space requirements. Known as the A-C-L kiln, the system will be made and sold here by Allis-Chalmers under license from Otto George Lellep, the inventor.

The system, which gives hot kiln exit gases two shots at the feed, has been used in Europe, but the A-C-L version will get its tryout by Marquette Cement Mfg. Co. in a new $7 million plant. Significantly, it will be built close to the heart of downtown Milwaukee, a city that's plenty strict on air pollution. (A single-pass version—the Lepol kiln—has been used a lot in Europe, too, and by at least two American firms, Ideal Cement and Santa Cruz Cement.)

Allis-Chalmers cites these advantages for its system over competitive ones.

• Heat economy—600-650,000 Btu./bbl. of cement, compared with 700,000 for the best competitor (the Humbolt preheater system), with 900,000 for the standard dry process, and with over 1,000,000 for the wet process kiln.

• Cleanliness—best ever for cement; dust loss from Marquette's 1.25-million-bbl./yr. plant will be 0.2 lb./min.—under 0.02% of production.

• Size—13-ft. diameter, 225-ft. long, compared with 11 ft. by 360 ft. for the dry process and 12 ft. by 450 ft. for the wet process.

The preheater system consists mainly of an 80-ft.-long moving grate. Raw material pellets (12% moisture, large proportion of fly ash, some limestone) are fed onto the grate. Gases from the rotary kiln at 1,800 F. pass through partially dried pellets and completely dry them. The gases, now at about 500 F., go to a cyclone dust collector. Then they're used to partially dry the moist pellets and go to a second cyclone. Last step for the gases is an electrostatic precipitator that gives them a final cleaning.

## Triple-threat Zimmermann process

Now ready for pollution-conscious pulp and paper makers is a new process that eliminates stream pollution, supplies process steam or electricity and recovers goodly amounts of inorganic pulping chemicals. Sounds like quite a package.

Invented by Sterling Drug executive Frederick Zimmermann (and offered for license by Sterling), the process's first commercial trial will be in a $3 million unit to be built near Oslo by Aktieselskapet Borregaard, Norway's biggest paper and pulp manufacturer. It will handle waste liquor from a 500-ton/day pulp mill.

In essence, the process is this: Spent pulping liquor is charged to a closed reactor with compressed air at about 800 psi. and near 500 F. Inorganic chemicals in the liquor are oxidized and organics both oxidized and cracked. Hot gases and steam pass out one end of the reactor, inorganics and excess water go out the other. (If operating on a sulfite liquor, presumably you would recover sodium sulfate, then convert it back to sodium sulfite for new liquor).

Up to 20% of the heat of combustion is needed to keep the reaction going. But the rest is avail

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able for plant use. Here you have a choice. The Norwegians, who have plenty of hydroelectric power, will use the heat to make 220,000 lb./hr. of process steam and thus save well over $1 million/yr. by minimizing need for imported fuel oil now burned in production of steam.

In low-cost fuel oil areas like the U. S., though, the emphasis may well be on production of electricity by running the steam through a turbine. Zimmermann's hope is that enough electricity could be produced to supply most—and possibly all—required to run the unit's air compressor.

### The ins and outs of atomic power

Hard on the heels of Monsanto's surprise announcement that it is pulling out of the nuclear power field comes word from Dow Chemical that it will move back into the field with a "rather large" experimental power reactor. (Late last year, Dow withdrew from a reactor study group it had helped form.)

Monsanto, active in atomic energy since 1951, shut down its power plant work after a proposal on which it had worked in behalf of Yankee Atomic Electric Co. was turned down by AEC for reasons never officially disclosed. But while de-emphasizing the power side of the atom, Monsanto plans to intensify its efforts in applying nuclear radiation to chemical processing.

John Grebe, head of Dow's nuclear program, said, in revealing the company's plans, that uranium dissolved in bismuth will fuel the reactor. He added that he expects this type of reactor to become the "work horse" of the atomic power industry.

For the reactor moderator, Grebe lists a host of possibilities. Likely bet: Dowtherm C, a mixture of di- and triphenyls. About 25 years ago, Dow launched its Dowtherm A by building a power plant that showed its heat transfer characteristics to advantage. The reactor may well prove a parallel.

### Polyethylene gets more crowded

Who's going to make what kind of polyethylene by what process? With all the fast-changing licensing activity in the field you'll soon need a tout sheet to keep track of the entries.

Latest to reveal new polyethylene plans are Hercules Powder, Celanese and Union Carbide. Hercules is going to build a $10 million, 30-million-lb./yr. plant at Parlin, N. J., that will use the near-atmospheric-pressure Ziegler process (Chementator, April 1955). Celanese and Carbide, like Grace, have licensed Phillips Petroleum's moderate-pressure process (Chementator, June 1955).

Unlike other Ziegler licensees, Hercules is going to be able to skip pilot-planting and go commercial immediately because it has contracted for considerable knowhow from Farbwerke Hoechst of Germany. Hoechst, one of the first Ziegler licensees, has a big plant coming on stream very soon and will supply Hercules with test-marketing quantities of the new polyethylene until the latter gets into production late next year.

Neither Celanese nor Carbide has said it will definitely build a commercial plant to use the Phillips process (Grace has). But betting is strong that both will. Reason: Reports (unconfirmed by Phillips) that all licensees of the process must build a plant or pay a heavy forfeit.

Almost certainly, these are not the last firms Phillips will license. A lot of companies (very likely including the French chemical giant, St. Gobain) are negotiating. Some of these, like Carbide, are already licensed by Ziegler. Carbide—also the biggest maker of conventional high-pressure polyethylene—explains its triple licensing position this way: Though they feel certain that the high-pressure type "will be cheaper," the improved high-temperature characteristics of the new types will open markets for all three varieties.

### Vital transport items face Congress

Chemical process industry men will have watchful eyes on the transportation legislation due for airing in the coming Congress. Three main topics are on the docket:

- Repeal of wartime transportation taxes.
- More rate-cutting freedom for common carriers.
- Boosts in barge transport rates.

Olin Mathieson's Don Ward heads the National Conference for Repeal of Taxes on Transportation, backed by all major transport industry associations. The conference will push hard to shove the 3% freight tax off the books. It went on during World War II in a try to cut unessential traffic.

But there's little change for repeal. Since 1956 is an election year any tax relief will head voteward—to individual income taxes.

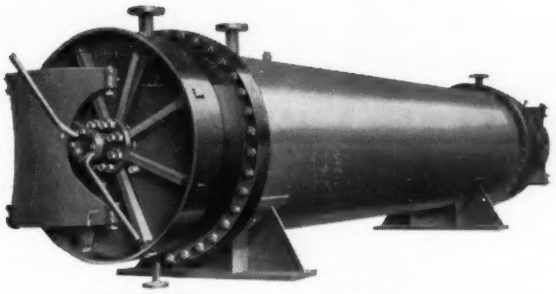
There'll be a ruckus over proposals by the Cabinet Transportation Committee to give common carriers, whose rates are set by the ICC, more latitude to cut rates to meet competition. Such powers favor railroads, hence, face strong trucker

(Continued on page 108)

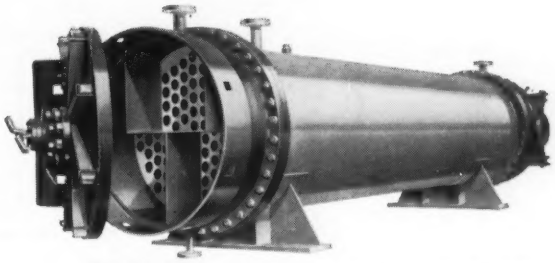
# Heat Exchangers Open in 5 Seconds

## with new p-k Lever-Lock Door*

**Substantial savings seen for processors of high-fouling liquids and others who must clean and inspect heat exchangers regularly.**



**CLOSED,** the Lever-Lock looks like this. A single 1/6th turn of the lever draws back the lock bars.



**OPENED** manually with an easy pull, the tubes and tube sheet are easily accessible.

Anyone who has had to open a heat exchanger knows how time-consuming and costly it can be. Dozens of bolts must be loosened. Specialized labor is often required. Now these problems can be things of the past. p-k's Lever-Lock Door, available on p-k heat exchangers, provides *five-second access* to the unit—and a new approach to exchanger design. The door "unlocks" with a 60° manual turn of a lever. In horizontal position the door then swings open easily. In vertical position, it is lifted by means of a pneumatic cylinder. Either way, it seats itself automatically on a long-life, self-sealing gasket. Other features allow Lever-Lock to be used in a wide range of applications:

- **Available in all alloys**
- **Pressure range from full vacuum to 300 psi**
- **Temperatures to 400°F. (Special alloys for sub-zero applications)**
- **Mechanical lock available to prevent opening vessel when pressurized**
- **No maintenance other than simple lubrication**
- **Available in diameters from 16" through 36"**

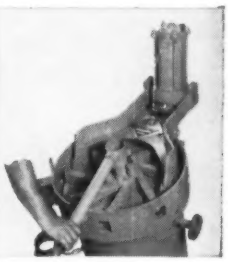
Lever-Lock doors have been used successfully not only on p-k heat exchangers, but on p-k autoclaves and sterilizers in the chemical, textile, food processing, and rubber manufacturing industries as well. For all of them, and wherever exchangers carry high-fouling liquids or require frequent entry for cleaning and inspection, Lever-Lock doors pay for themselves through savings in time. Heat transfer can be more efficient, too, since you can afford to remove gunk more frequently.

But this is only part of the story. If you see the Lever-Lock as the answer to a perplexing problem in your plant, why not write for *all* the facts, *today?*

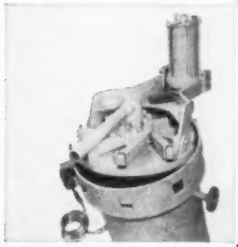
**The Patterson-Kelley Co., Inc., 220 Lackawanna Avenue, East Stroudsburg, Pa., and principal cities**

*Pat. Pending

**1.** This autoclave is in vertical position with its Lever-Lock Door equipped with a pneumatic cylinder.



**2.** To open, operator merely gives lever a 1/6th turn that releases lock bars.



**3.** Door is lifted in 5 seconds—automatically! An hour or more of work is saved.

Write for new p-k Bulletin No. 2030 for full details.

# PATTERSON-KELLEY

2575

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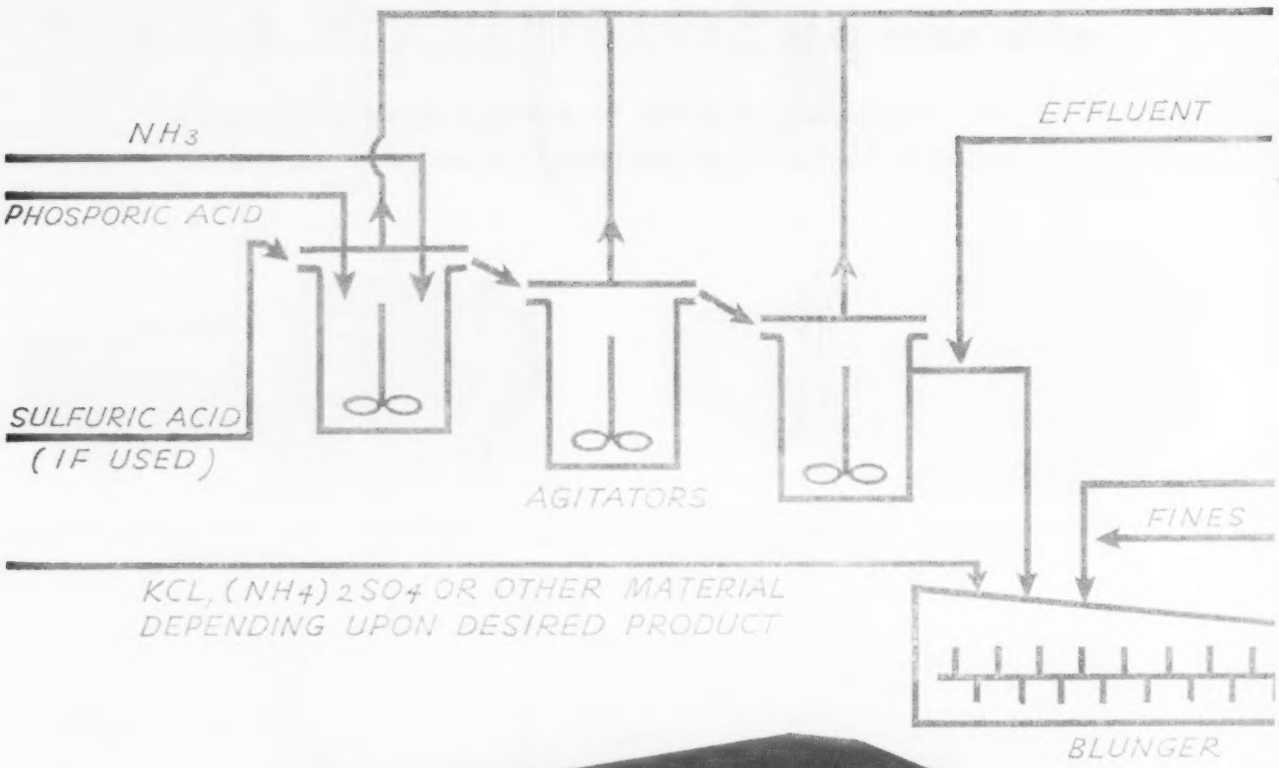
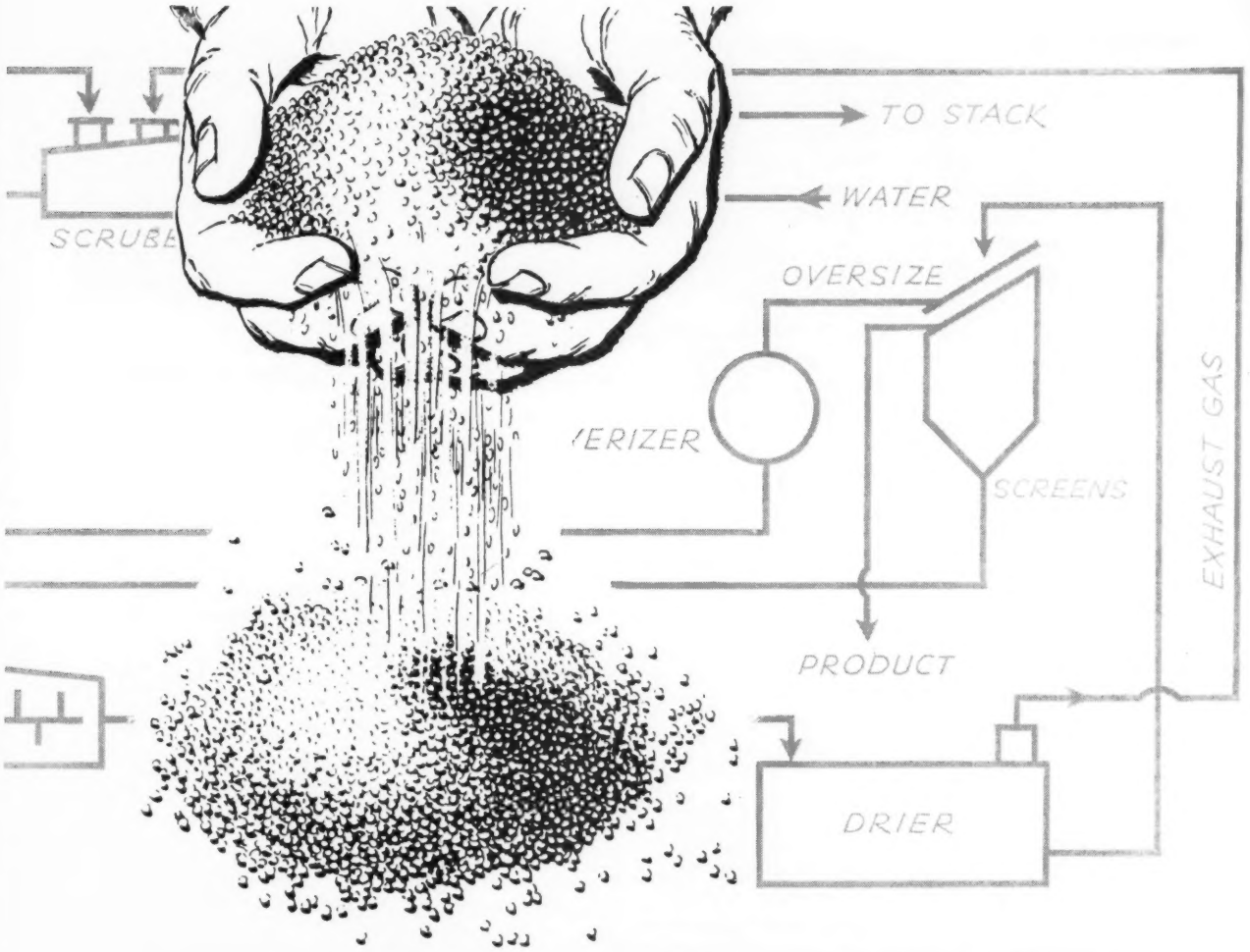



# NEW!

## The Dorrco Diammonium Phosphate Process




## Proved out at Missouri Farmers Association Granular Fertilizer Plant...

The first commercial production of diammonium phosphate based fertilizers took place last November at the new MFA Fertilizer Plant near Joplin, Missouri. Full design capacity of 200 TPD was reached less than three months later. An improvement in the Dorrco Granular Fertilizer Process, this new method can be readily adapted to existing plants.

The Dorrco Diammonium Phosphate Process can produce directly from 32% $P_2O_5$ acid a fertilizer analyzing approximately 18-48-0 (N-$P_2O_5$-$K_2O$ basis). Iron, alumina and other elements go directly into the product where they assist granulation. The use of dilute phosphoric acid, purification by filtration and crystallization are all avoided. Final product is composed of closely sized, spherical, free flowing granules and size can be controlled over a wide range by proper selection of screens. The presence of a small percentage of monoammonium phosphate insures stability of the product.

*If you're interested in diammonium phosphate fertilizers, let us send an engineer to discuss this new development from the standpoint of economics and process. No obligation, of course.*

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opposition. They have only a slim chance to pass.

On barges, there are two proposals. The Hoover Commission suggests setting use charges on locks, canals and other government owned and maintained waterway facilities. This, too, rates only a slight chance for approval.

The cabinet transport group offers the other—putting now-unregulated barge lines under ICC control. This hits bulk chemical and oil shippers, big users of the unregulated lines. Pointing up its importance, Olin Mathieson's Ward said recently that if this passes, O-M will set up its own barge shipping subsidiary.

### Algae turns fertilizer producer

Makers of nitrogenous fertilizers may be in for competition from the blue-green algae commonly found growing wild in rice fields and long thought a nuisance and contaminant.

Recent experiments at the University of California show that, in the laboratory at least, this strain can fix atmospheric nitrogen at rates up to 480 lb. per acre per month—equal to some 2,300 lb. of ammonium sulfate.

In field tests now planned, organic nitrogen yields from the blue-green will be compared with those made by legumes and certain bacteria. Current work indicates that the blue-green, which unlike legumes and bacteria acts through photosynthesis, will show far higher yields.

Drawback of this algae is that out of the lab it grows only in a flooded field. This limits its use to rice crops and only a few others. But researchers have already begun the search for other nitrogen-fixing algae that need less water.

### Watch for new tariff actions

The clause in the 1955 Tariff Act allowing the President to restrict oil imports may have special chemical significance. For it's applicable to any commodity, import of which may hurt a defense-essential industry.

There's a test case now in the works concerning digitoxin, the foxglove-derived material used to treat heart disease. Sole U. S. producer is I. P. Callison & Sons of Seattle, and imports, at prices below domestic cost, are big enough to threaten Callison's production setup.

Under the procedure set up by law, if a material is considered essential to war, the Office of Defense Mobilization recommends to the President that a formal hearing be held. On his own decision, the President may call such a hearing to determine whether domestic production is being hurt. If it is, the President may then act. Among possible orders: one to limit—or completely prohibit—imports.

Present ODM consideration of digitoxin could well lead to recommendation to the President for a formal hearing. And since 5-10 million residents are considered present or potential users of the material, there's substantial chance for action.

### Three firms synthesize natural rubber

Firestone and Goodyear have joined Goodrich-Gulf in synthesizing natural rubber. Unlike conventional synthetic rubbers, these new materials have molecular structures very similar to Hevea natural rubber.

Both Goodyear and Goodrich-Gulf use a Ziegler-type catalyst (triethyl aluminum plus cocatalyst) to make cis-1,4-polyisoprene plus small amounts of its trans stereoisomer.

Firestone's new rubber is all cis-1,4-polyisoprene—containing neither the trans isomer nor distinguishable amounts of 1,2 structure. It's made by polymerizing isoprene with a lithium catalyst.

The cis-1,4 structure is far more like Hevea natural rubber than older, emulsion-type preparations of polyisoprene. And it's primary market will be heavy-duty tires, where wear resistance and ability to disperse heat are important, and mechanical uses—not yet fully explored.

Costs will be somewhat higher than GR-S but it's expected to compete favorably with natural rubber at present prices. Some observers see these three companies using the new rubber to replace natural in up to 75% of its uses in a year or so.

Good building tack of uncured polyisoprene and the low hysterises of the cured stock is an improvement on GR-S. Its cracking resistance and heat stability are better than natural's.

### Sun rises on power horizon

"A Geneva conference for solar energy!" That's what they're calling recent meetings of sun power enthusiasts at Phoenix and Tucson, Ariz. Scientists and industrialists from some 35 nations went home full of new ideas culled from hearing 114 papers and inspecting 50 exhibits. Some conclusions:

• Efficiency isn't too important when dealing with an unlimited supply of free fuel. Conversion of only 5% of the incident solar energy will be economical once storage problems are licked.

(Continued on page 110)

# "HYPO" USERS...
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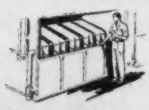

**TEXTILES**
Assist in dyeing, printing; also used in making synthetic dyes.

**MISCELLANEOUS USES**
Bleaching groundwood, straw, fur. Organic chemical manufacture; water treatment.

Stocked for immediate shipment from distribution points throughout the U.S.A.

### *Major Processing Advantages*

General's Anhydrous "Hypo" is a sparkling, crystalline, water-free product that assays 98% $Na_2S_2O_3$. It is free from caking tendencies common to ordinary hydrated "Hypo"... dry feeds well... dissolves rapidly in water to give clear colorless solutions free of troublesome impurities.

### *Improved Handling and Storage*

High density and reduced bulk add to shipping economy and handling ease. Long shelf life is another advantage of particular importance to manufacturers of photographic supplies.

### *Now—3 Producing Centers*

The demand for General's Anhydrous Sodium Thiosulfate has resulted in *three* producing centers... a three-to-one advantage over any other supplier. Newest of these recently went on the line at North Claymont, Del. Yes, with General's three-point source of supply, you get shorter shipping hauls, lower cost, dependable deliveries, better service. Add this to top quality—and you know why so many careful buyers insist on General Chemical Anhydrous "Hypo." Make it your choice, too.

• • •

**For Hydrated "Hypo"**...order General Chemical's high quality Standard Sodium Thiosulfate. Produced in grade size for all requirements.

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• Scientific and engineering needs are already defined. Main problem now is finding materials to fill them.

Of the several ways to convert photons into electric power which were outlined, a chemical method got much attention. One example of it is catalytic dissociation of water with solar energy. The energy can then be stored as hydrogen. Coupling this system with the Bacon fuel cell which converts $H_2$ and $O_2$ into water while producing electricity (*Chem. Eng.*, Sept., 1955, p. 136) combines conversion, storage, generation and application. MIT, Stanford Research Institute and others are working on this system.

Approaching commercial use is a sun-powered furnace in France. It's made high purity zirconium oxide from zircon at 5,000 F., commercial amounts of Ti $O_2$ and melted 100 kg.-batches of iron. With a few design changes, it's expected to produce metallurgical specialties competitively.

Privately, some experts bemoan the lack of worthwhile cost data on the various steps such as collection, conversion, storage, etc. Current studies usually show the goal for over-all costs.

### New formulas bid for bleach market

With finished cotton goods racking up impressive yardage gains this year, two major makers of hydrogen peroxide bleaching solutions, Food Machinery and Chemical's Becco Div. and Du Pont, are now testing new phosphate-based formulas which erase troublespots in today's continuous bleaching systems.

Working with Dan River Mills, a textile maker, Becco has developed a phosphate-stabilized bleach that skirts the scaling problems brought on by the silicate-stabilized alkaline peroxide bleaches used universally.

Becco puts a disodium orthophosphate solution, buffered with borax, into the cotton goods saturator along with the peroxide. The solution reacts with calcium in both the cotton and in the water to form a calcium phosphate precipitate which stabilizes the peroxide at the 210 F. bleaching temperature. To make sure that there's enough calcium to form sufficient solid, a small amount of calcium chloride solution is added continuously.

This system, now on full scale trial runs, is said to outdo silicate stabilizing by:

• Eliminating equipment scaling and saving production now lost during cleaning downtimes.

• Reducing seconds and rejects caused by abrasive action of the scale.

• Preventing silicate deposits on the cloth. These cause uneven dyeing.

Du Pont's new bleach formula, now getting limited field tests, also avoids these pitfalls. Its peroxide stabilizer consists of sodium tripolyphosphate (2% by weight of bleach solution), a sequestering agent and epsom salt.

At present, most bleachers are cautious in appraising the solutions, awaiting more chemical evidence. Costs are the main drawback. Becco estimates that its silicate-free preparation now runs from 60¢ to $1.00 per 1,000 lb. of cloth higher than conventional solutions.

But it's hoped that current tests will prove the advantages of the new solutions are worth the extra fee. If so, both Becco and Du Pont expect a substantial market for their solutions.

### Refinery re-uses waste water

To lick the double problem of waste disposal and high water costs, Sun Oil Co. has revised treatment of waste water at its Toledo, Ohio, refinery. Bio-oxidation is the key, and Sun says it has cut pollution, provided a new low-cost water supply and created a high-volume emergency fire protection facility.

Sun uses a flue gas stripping tower to remove sulfides—which cut biological activity and cause corrosion—from its process wastes.

These waters and all other weakly alkaline wastes pass through an API separator to remove oil and solids, then go to an impounding basin (maximum capacity, 8 million gal.). Water is held in the basin 5-8 days to remove residual oil and permit preliminary biological action. Then it enters the cooling recirculation system.

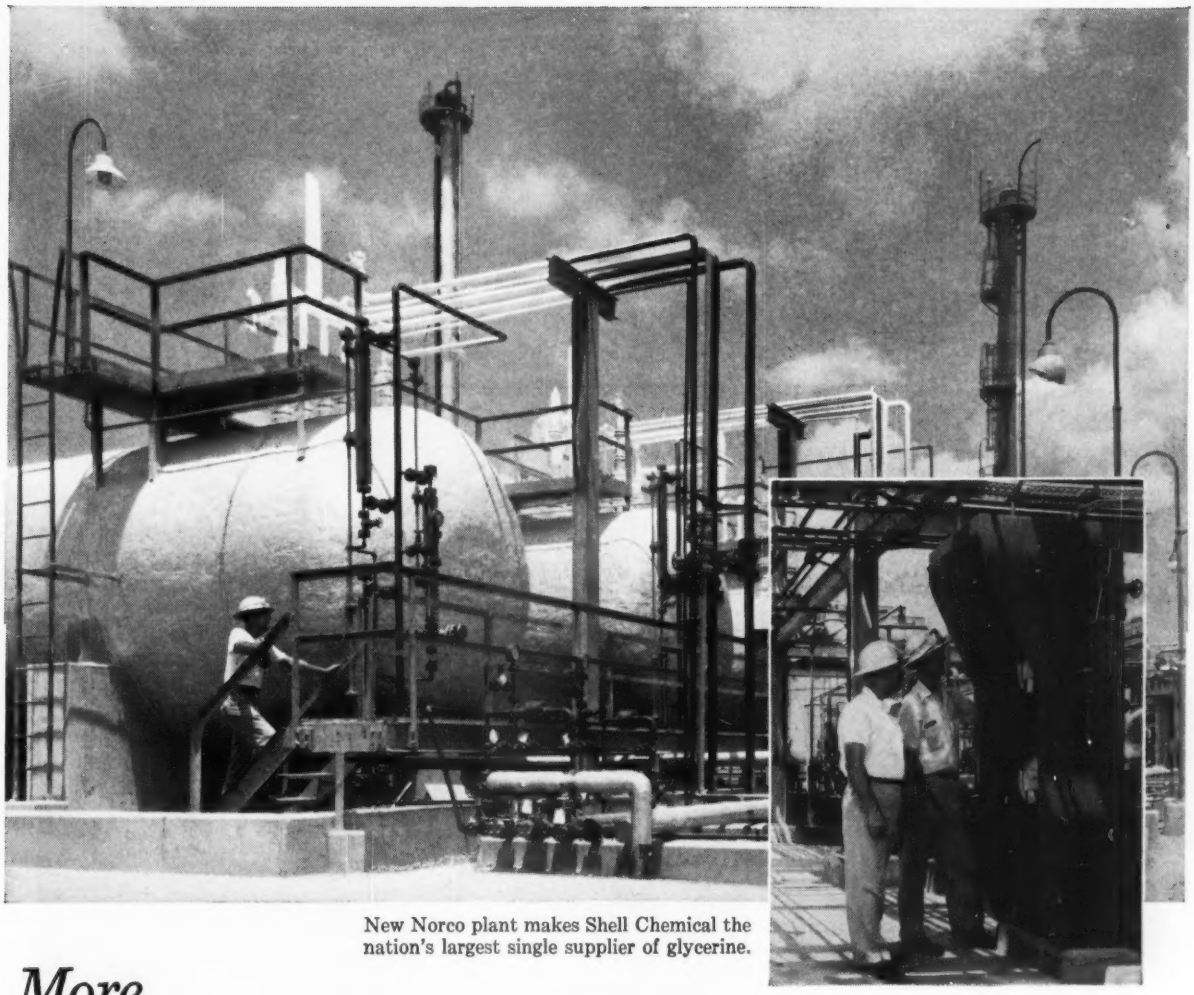
Forced draft cooling towers, rated at 18,000 gpm., act as trickling filters. The 90-100 F. water temperature, extensive internal contact surfaces of wood, use of waste water and excess oxygen provide an ideal environment for biological activity.

Phenol-consuming organisms present consistently cut phenol content over 99% during recirculation. Chemical oxygen demand is also substantially lowered. Sun credits the phenolics and the phenol-consuming bacteria with eliminating algae growths normally formed in the cooling tower and with controlling slime throughout the system.

Little acid is needed to neutralize the alkaline wastes. Carbon dioxide, formed as phenolics and other organics decompose, keeps the pH low.

Importantly, re-use of waste water hasn't sliced into heat transfer efficiencies in the cooling equipment. And reducing dissolved oxygen in the cooling water slows corrosion.

**For more of WHAT'S HAPPENING . . . . . 112**



New Norco plant makes Shell Chemical the nation's largest single supplier of glycerine.

# *More* Glycerine *on stream!*

**Seven years ago,** Shell Chemical startled industry with this news . . . high-purity *synthetic* glycerine, produced from petroleum, in commercial quantities!

Now . . . more good news for glycerine buyers! A new plant (Norco, Louisiana) is now on stream, adding further to the supply of uniform, high-purity glycerine.

And looking toward the future, Shell Chemical is building a plant for *an entirely new synthetic glycerine process*, using hydrogen peroxide and acrolein as raw materials.

Whether your glycerine requirements are small or large . . . a drum or a tank car . . . Shell's key storage facilities assure prompt delivery. Write for delivery information and specifications.

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DECEMBER
1955

# What's Happening

**Feature News This Month**


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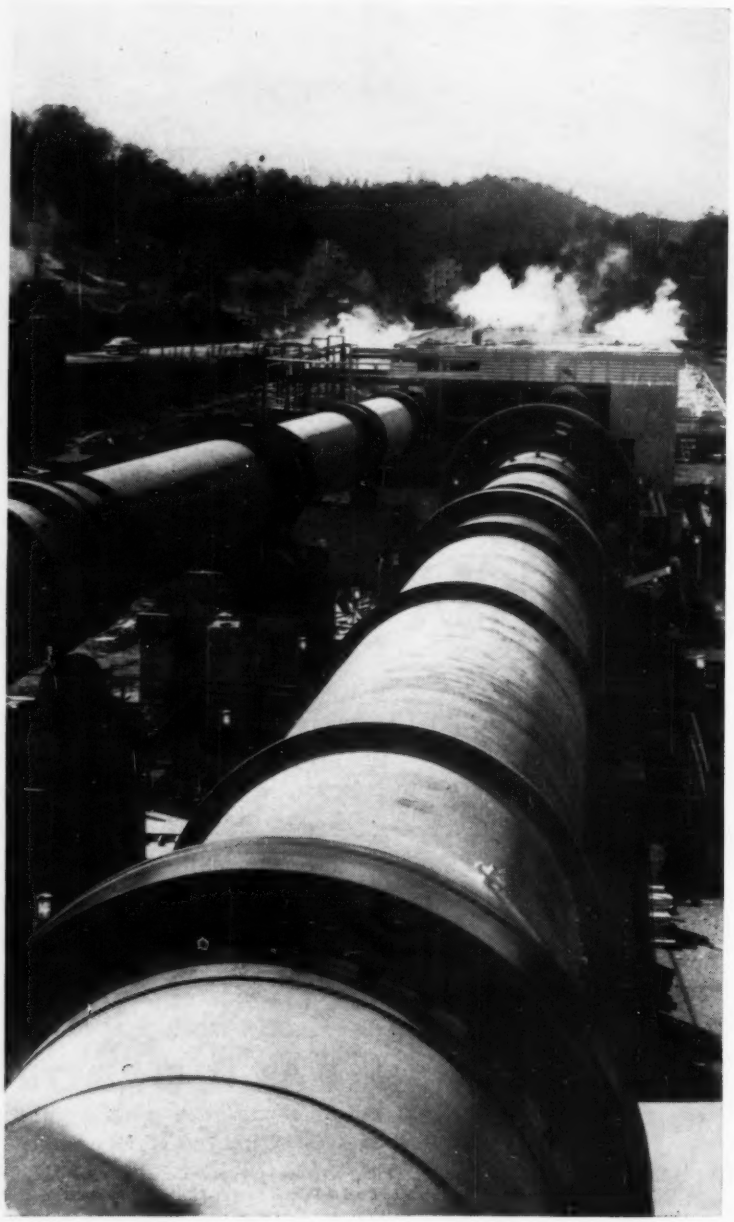


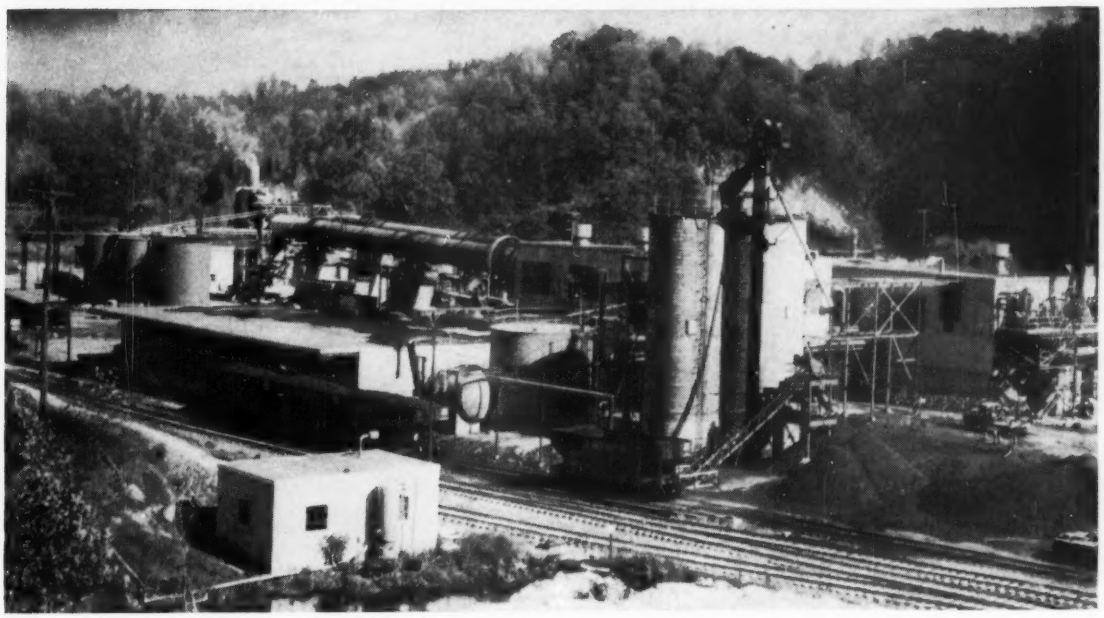
## Detergents From Sugar Look More Promising

By reacting an excess of sucrose with the fatty acid ester of a volatile alcohol in a solvent, Foster D. Snell, gets better than 90% conversion to sucrose monoesters that show considerable promise as nonionic detergents. Nontoxic, odorless and tasteless, these detergents are free-flowing powders, not liquids like most nonionics.

Snell's work, paid for by the Sugar Research Foundation, first resulted in a process for making detergents from sucrose and tallow. Even though conversion was only about 50%, several firms were eager to license the technique. Now that conversion has been upped to 90%, it seems certain that commercial interest will zoom.

And the process may go further, too. For by using a dibasic acid you get a polymer; using a linseed oil ester you get a drying oil.

# *in Chemical Engineering*



**Foote Mineral's Sunbright plant—built in '53, enlarged in '55—betokens . . .**

## Capacity Boosts for Lithium Chemicals

THE NEW rotary kiln at the far left is a major feature of Foote Mineral Co.'s just-ended expansion of lithium chemical facilities at its Sunbright, Va., plant. The Sunbright plant was originally completed only two years ago.

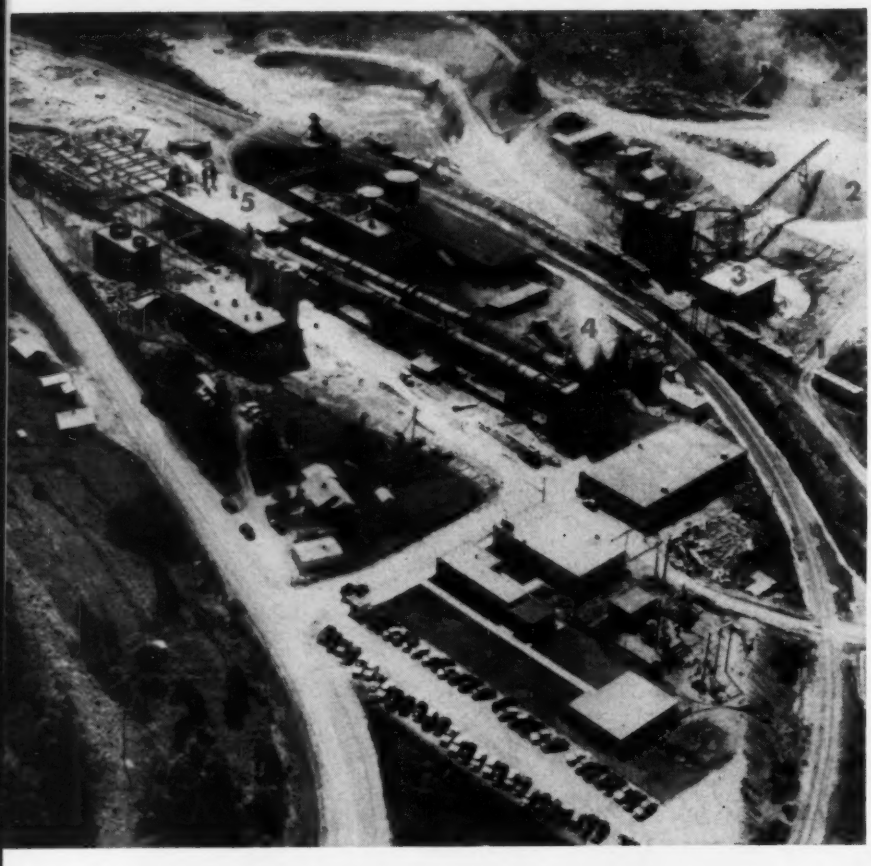
Expansion now has the spotlight on the lithium stage. With a bright future for lithium compounds virtually assured by a growing list of civilian uses and substantial, but secret, military applications, suppliers are upping capacity throughout the nation. In addition to Foote:

• Maywood Chemicals, Maywood, N. J., a lithium pioneer, is now boosting output from present facilities in addition to installing new capacity.

• Lithium Corp. of America reports that it is "expanding so fast that expansion is almost continual."

• American Lithium Chemicals, a partly owned subsidiary of American Potash, expects to bring its $6.6 million plant—now abuilding at San Antonio, Tex.—on stream early in '56. Construction is now in the final stages, running about a month ahead of the original schedule.

▶ **Start With Spodumene**—At Sunbright, Foote processes spodumene, the major lithium mineral, in a series of operations similar to those used to make wet-process cement and to the Bayer process for re-



**Process Flow at Sunbright**

1. Lithium-containing spodumene arrives from mine by rail.
2. Local limestone is trucked in and stockpiled.
3. Spodumene is co-milled with limestone slurry and mix sent to kiln.
4. Kiln calcines mixture forming sintered pellets containing $LiO_2 \cdot Al_2O_3$.
5. After cooling, pellets are milled with water to hydrolyze CaO.
6. Slurry passes through a series of digester tanks.
7. Muds are settled out in concrete thickening tanks.
8. Liquor is filtered and evaporated to crystallize $LiOH \cdot H_2O$.
9. Centrifuging separates LiOH crystals and recycle liquor.

covering alumina from bauxite. Sunbright is the first major facility to use this method.

Spodumene, $Li_2O \cdot Al_2O_3 \cdot 4SiO_2$, occurs in the pegmatic ore mined at Kings Mountain, N. C. Foote puts the ore through a flotation process at Kings Mountain, and ships spodumene-rich concentrate to Sunbright in covered hopper cars.

There, spodumene is ball-milled with a measured amount of a limestone-water slurry. Foote mines the limestone near the Sunbright plant. After blending, more water is added and the slurry pumped to storage tanks equipped with both mechanical and air agitators.

► **Kilns Calcine**—The slurry then goes to one of the 10-ft. dia. by 340-ft. long rotary kilns for calcining. In the coal-fired kiln, limestone and spodumene react to produce a sintered product—in the form of 1-in. pellets—containing CaO, $2CaO \cdot SiO_2$ and $Li_2O \cdot Al_2O_3$.

After air-cooling, sintered pellets are milled with overflow liquor from a later thickening operation. Here the CaO hydrolyzes to $Ca(OH)_2$ which then reacts with the $Li_2O \cdot Al_2O_3$ to yield $CaO \cdot Al_2O_3$ and $LiOH \cdot H_2O$.

► **Digesting Slurry**—A slurry of reaction products discharges from the mill to a rake classifier. Overflow from the classifier passes on to a series of digester tanks. Digested slurry is thickened and water-washed in a series of concrete thickening tanks.

Strong liquor from the thickeners gets filtered before going to a triple-effect evaporator to be concentrated. In the third effect lithium crystallizes out as lithium hydroxide monohydrate. Centrifuging spins out the final product in solid form.

► **Recycle Liquor**—Liquor from the centrifuge is further evaporated in a single effect and remaining LiOH is crystallized and filtered in a thickening filter. Concentrated liquor is recycled.

The lithium hydroxide is used in ceramics, greases and a host of other applications.

## Dow Moves In Three Directions

Using a brand new process, Dow Chemical Co. has just started up a $3 million Freeport, Tex., plant which marks its entry into soda ash. To make 300 tons/day, the plant uses cell liquor carbonation to avoid costly evaporation.

Also at Freeport, the company is completing units that will boost ethylene glycol and ethylene oxide capacity by 60 million lb./yr.

And a $13.5 million expansion is planned for the AEC plant operated by Dow at Rocky Flats, Colo. Early 1957 is set for completion of construction, which will be handled by Catalytic Construction Co. of Philadelphia.

*C. J. McFarlin, President, Air Reduction Chemical Company, a division of Air Reduction Company, Incorporated.*

# *McFarlin of Airco*

## Integration, location and lots of vinyl acetate

*"Our new vinyl acetate plant at Calvert City is another development in Air Reduction's chemical expansion. The Lummus Company is engineering and constructing this plant for us and will bring it on stream early in 1956."*

In the midst of an abundance of available power, natural gas, water transportation and a host of related chemical products, Lummus is engineering and constructing an integrated 30,000,000 lb. per year vinyl acetate plant for Air Reduction Chemical Company, a division of Air Reduction Company, Inc. Adjacent to Air Reduction's National Carbide Division, it receives pipeline acetylene and converts it into vinyl acetate which goes principally into polyvinyl acetate emulsions, used in adhesives, latex paints and textile finishes — and polyvinyl alcohol, used for adhesives and textile finishes.

At Calvert City, in addition to this new Air Reduction plant, Lummus is also building a $6,000,000 high pressure acetylene derivatives plant for General Aniline & Film Corporation which is a "first" in its field. What better examples could be given to show that Lummus is ready, willing and able to design, engineer and construct your next chemical plant.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y. *Engineering & Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Fabricated Piping Plant:* East Chicago, Indiana.

## Droves of Oil Firms Go Into Metal Searching

Membership in the growing search party for fissionable materials, rare earths, rare and base metals now includes about half of the oil companies operating in the Rocky Mountain district.

Latest to join the group in that area were Gulf Oil and the Texas Co. They were preceded by such firms as Phillips Petroleum and Continental Oil. The Standard Oil companies are now only probing wildcat holes for uranium.

Typical are the activities of El Paso Natural Gas Co.'s Rare Metals Corp. of America: They won a 200 ton/day uranium concentrator for the AEC's program at Tuba City, Ariz.; started up a 175 ton/day mercury reduction unit at Weiser, Idaho; leased vast properties in the West and in South America as likely sources of such metals as uranium and thorium.

## Wanted: Small-Scale Nuclear Power Plants

To encourage development of economically competitive nuclear power, the AEC has again invited industry proposals for small-scale experimental nuclear power plants. Capacity of proposed plants must be in one of the following kilowatt ranges: 5,000-10,000, 10,000-20,000, 20,000-40,000.

Types of assistance offered as possible rewards for appropriate proposals include: waiver of part of the Commission charges for use of source and special nuclear materials for a maximum period of five years; payment for technical and economic information resulting from the project; financing and retaining title to all or part of the reactor system.

This is the second such invitation. The first resulted last summer in two successful bids: Detroit Edison Co.'s fast breeder reactor plant with 100,000 kw. of capacity to be completed in late 1959; the Nuclear Power Group's boiling water reactor plant of 180,000 kw. capacity to be completed in 1960.

## More Cellulose and Other Wood Chemicals

Two new wood chemicals plants, one for cellulose and one for a new non-cellulose bark-derived dispersant for oil well drilling are now being built by Rayonier, Inc. of New York.

To produce 100,000 tons yearly, the $25 million cellulose plant will be completed in Jesup, Ga., by late 1957.

A $1 million plant in Vancouver, B. C., will start producing 20 tons/day of the new dispersant, called Rayflo, in the spring of 1956. Hemlock bark, Rayflo raw material, will come from the nearby pulp mill of Rayonier-subsidiary Alaska Pine and Cellulose Co., which is now undergoing an $8 million expansion program.

A polymeric polyphenol, Rayflo—developed by Rayonier and pilot plant produced until now—has been found less costly to use than imported dispersants like quebracho. Rayonier believes it will provide a price- and supply-stable replacement for imported dispersants which are scarce now and often.

## Self-Propelled Trucks Form Trackless Train

**New cross-country freighters needing neither tracks nor roads to carry materials in and out of underdeveloped areas may prove a boon to the chemical industry with its broadening markets and increased vertical integration back to raw materials. Each car is self-propelled with an all-wheel drive. Freighters can handle sharp corners (above), sand, snow, lowland areas, rocky terrain and steep grades. Made by R. G. LeTourneau, Inc., Longview, Tex., they cost from $30,000 to $500,000.**

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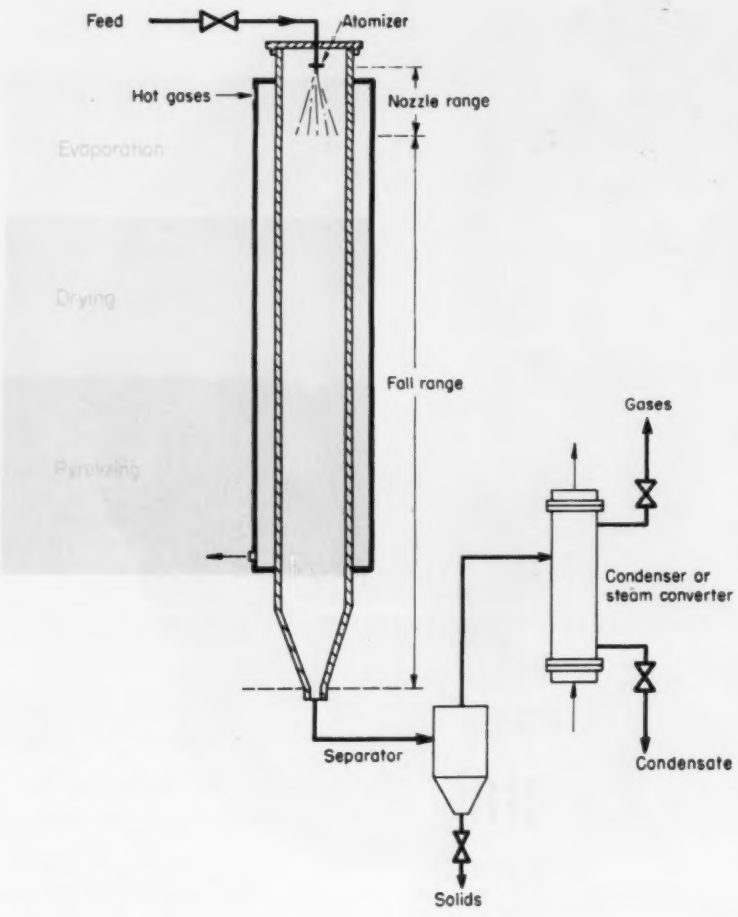
# New Tower Handles Three Process Steps




**In new concept, solutions are concentrated, dried and reacted by radiant heat in tower chamber. Unique operating traits open up new vistas for thermal processing.**

Rapid heat transfer and mass transfer characterize a new processing technique which appears slated for future stardom.

Called the "atomized suspension" process by its inventor, W. H. Gauvin of McGill University, Montreal, the new one-pass technique offers an economical method for evaporating, drying and thermal processing of solids from slurries or solutions. The equipment is inherently compact, simple and easy to control; corrosion and scaling are minimized.

The new technique, first announced publicly at a meeting of the Chemical Institute of Canada in June, grew out of three-year, $250,000 research program sponsored by the Pulp and Paper Research Institute of Canada and backed financially by 20 Canadian paper makers and their U. S. affiliates.

► **Differs From Spray Drying**—To some extent atomized suspension processing may appear to resemble spray drying. However, the two operations are fundamentally different.

Like spray drying, material to be processed is sprayed into the top of a vertical tower with the material moving downward. Both solids and vapor exhaust through the bottom of the tower.

Unlike spray drying, heat is provided by radiation from the jacketed tower wall, maintained at 1,100-1,500 F. by hot combustion gases flowing through the jacket.

No hot gases are introduced into the tower. Absence of an air film surrounding each droplet accounts for the rapid evaporation.

► **Where Story Starts**—When the Korean-fostered sulfur shortage became acute several years ago sulfite pulp producers faced serious curtailment of production. Approximately 20 Canadian sulfite pulpers and their U. S. affiliates underwrote a project at the Pulp and Paper Institute of Canada to develop an economical method for recovering sulfur from waste sulfite pulping liquor.

Under the direction of Prof. Gauvin the Institute program evolved the atomized suspension technique to recover 70% of the sulfur, plus other materials of potential value in the pulping liquor. But of even greater signficance is the potential application of the technique to other chemical processing problems.

Basic patent application has been made in Canada, Great Britain, the United States and a number of other countries by Prof. Gauvin. Patents, when issued, will be assigned to the Pulp and Paper Research Institute of Canada. The technique will be available on license but details as yet have not been worked out.

► **Opening Wedge**—First commercialization of atomized suspension undoubtedly will be in the pulping field. An economic evaluation of a recovery system for a 200-ton-per-

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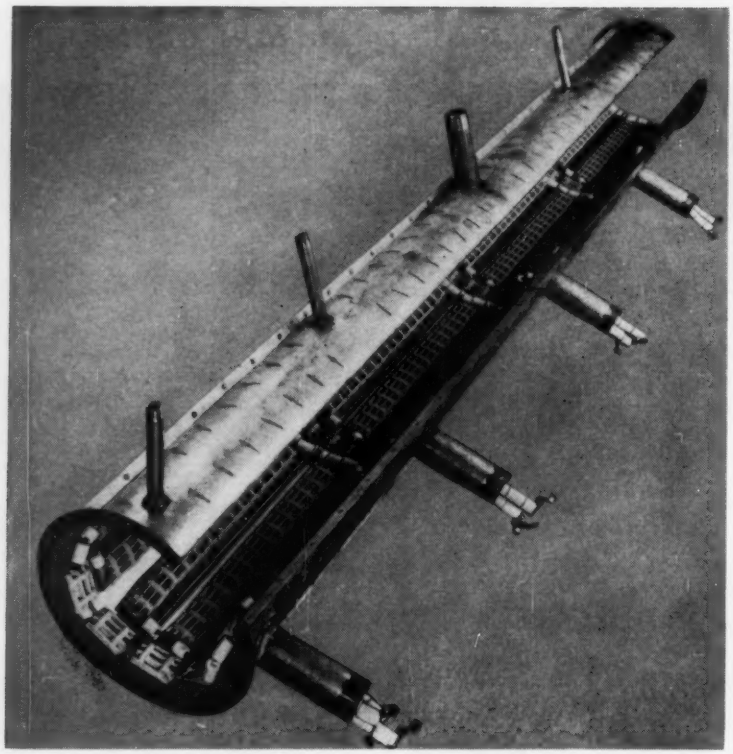


**HEATER for pilot unit consists of jacket with internal electric heating elements. Leads extending from jacket permit running zones at different temperatures.**

day sulfite mill indicates a favorable balance.

Treating weak liquor directly in the tower at 165 psig. and using all the byproduct 140 psig. steam, net yearly returns of $410,000 would be realized. This is the difference between operating costs and the sum of credits for sulfur and steam produced. Plant cost is estimated at $1,000,000.

For the present, Prof. Gauvin is predicting major use of the technique will be in treatment of industrial streams to recover chemicals either by pyrolysis or chemical treatment. And he already is working on pilot evaluations to extend the technique beyond the pulp and paper field.

▶ **Down-Flow Design** – Atomized suspension is carried out in a simple, jacketed, tower chamber operated as a down-flow unit. Hot gases from combustion of coal, oil or gas circulate through the jacket to heat the tower wall.

Hot feed solution, slurry or suspension enters the top of the tower through a pressure nozzle that produces droplets with average diameters of 25-30 microns. Over a distance ranging from nine inches to several feet the droplets decelerate in 0.01-0.1 sec. to constant terminal velocity. Spray angle is adjusted to prevent droplets from impinging on the walls during deceleration in this nozzle zone.

Tower wall in the nozzle zone at a temperature of 1,100-1,500 F. radiates heat to the droplets. Due to the large surface area of the droplets and their violent oscillation and vibration, evaporation proceeds very rapidly.

Water vapor shields the radiation somewhat, yet even so tests have shown heat transfer at 81% of calculated theoretical rate at a wall temperature of 600-890 F.

Leaving the nozzle zone, droplets enter the fall range. Here constant and falling-rate drying occur, followed by pyrolysis or chemical reaction.

During the evaporation and constant rate drying stages the droplets or particles assume the saturated temperature corresponding to the pressure in the system. Particle temperature will climb to a higher level under falling rate conditions than it would in spray dryer. Thus, atomized suspension is not well adapted to treating heat-sensitive materials.

▶ **Rapid Reaction**—Comparative pyrolysis tests using spray-dried solids in fixed bed and fluidized bed reactors versus the atomized suspension tower indicate a many-fold increase in reaction rate using the tower.

Present theory favors the belief that in the tower water vapor almost explodes out of the particles during evaporation and drying. Result is ragged, deeply pitted surfaces (confirmed by microscopic examination) that greatly increase surface area available for reaction.

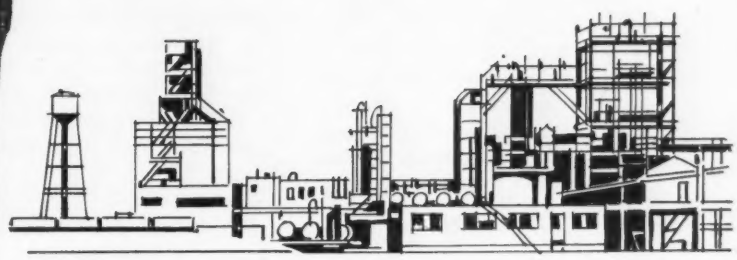
To date, only pyrolysis and oxidation reactions have been carried out. Reduction is slated for early trial. Others possible include nitration and catalyzed reactions.

Leaving the tower the stream is stripped of solids, condensable and absorbable fractions, and heat. Operating at atmospheric pressure the steam is condensed; above atmospheric a steam converter makes clean steam for plant use. Noncondensables must be vented or handled by some other means.

▶ **Pressure for Economy**—If the tower operates at atmospheric pressure heat is recovered only from hot condensate or from combustion flue gas by preheating feed and combustion air. Heat economy is but slightly better than a spray dryer and considerably less than a multiple-effect evaporator.

Heat balance is much more favorable if the tower is operated under pressure. At 150 psig. all the heat of vaporization supplied to the tower can be recovered in a steam converter as clean 125 psig. steam. In turn, some of this steam can heat a multiple effect evaporation system for concentrating dilute feed ahead of the tower, while the rest is available for plant use.

# Mr. Engineer: Check Your Future Here



With your present company, how does your future look? — are your future prospects excellent, average or poor? . . . Take this three-minute quiz to compare your present position with a future at Chemstrand.

| | Your Present Job | | | CHEMSTRAND | | |
|---|---|---|---|---|---|---|
| | Excellent | Average | Poor | Excellent | Average | Poor |
| ***What are the indications for expansion of the industry in which you are presently employed?*** It is estimated that the chemical-textile fibers industry will expand 1100% within the next twenty years. Source: U.S. President's Materials Policy Commission report dated June, 1952. | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ |
| ***Does your present job provide a real climate for personal satisfaction?*** You will have ample opportunity in Chemstrand's modern up-to-date plants and laboratories to exercise your imagination, initiative and ingenuity and to make a real contribution toward the progress of the company and the industry. | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ |
| ***How are your living conditions?*** The "New South" offers ideal climate, excellent recreational facilities, exceptional schools. Chemstrand plants are located in Decatur, Alabama, and Pensacola, Florida. | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ |
| ***Do you enjoy a complete employee benefit program?*** Life insurance for employee and medical, surgical and hospital protection plans for both employee and dependents, and a modern pension plan — all at a low cost to the employee — plus paid vacations and holidays are provided at Chemstrand. | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ |
| ***Are your abilities being given full recognition?*** Individual assignments are made at Chemstrand with a view toward development of executive capabilities. You are not placed in a "pool" of engineers at Chemstrand. | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ |

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## General Hull Keynotes CE Award to Dow Corning

General John E. Hull, President of the Manufacturing Chemists Association and former U. S. and UN commander in the Far East, will give the keynote address when the Chemical Engineering Achievement Award is presented to the Dow Corning Corp. in Philadelphia, December 7th. At that time, General Hull will discuss "Leadership—The Key to Industrial Development."

The Award will be presented to Dow Corning at a banquet of the chemical engineering profession in the Bellevue-Stratford Hotel, Philadelphia, midway through the week-long 25th Exposition of Chemical Industries. Chosen by an 84-man committee of chemical engineering educators, Dow Corning Corp. will be honored for its pioneering accomplishments in the commercial development of the silicone industry.

## Du Pont Reveals Raft of New Plans

A new process, two expansions and the halting of polyethylene film output made news at Du Pont last month.

The process is a continuous method of dyeing Mylar polyester film developed by Julius Hermes, president of the Martin Processing Co., a new firm in Martinsville, Va. Colors actually become part of the film, eliminating abrasion problems and assuring much better light fastness and heat stability. The process, which involves dyeing, washing in boiling soapy water, rinsing in clear water and drying, is particularly suited for metallized fabrics and yarns.

One Du Pont expansion is a multi-million dollar addition to the new tetraethyl lead and refrigerants plant now abuilding near Antioch, Calif. It will turn out sodium, ethyl chloride, trichlorethylene and perchlorethylene. No capacity has been revealed, but the unit should be completed early in 1957. The other expansion is at Orange, Tex., and will boost polyethylene capacity there by modifying the existing plant. Operations are expected by mid-1956.

While it is increasing polyethylene resin capacity, Du Pont has decided to drop its small polyethylene film operation at Buffalo, N. Y. There are 29 other producers, but main reason for the move is a desire to speed development of other films, particularly cellophane and Mylar.

## Another Expansion Of SRF Carbon Black

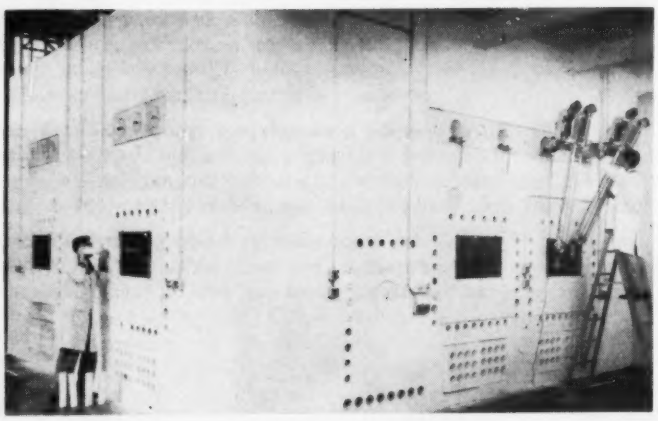
A new 20-30 million-lb./yr. carbon black unit for J. M. Huber Corp.'s Borger, Tex., plant will go into production late in 1956.

Like a similar-size plant now being built by Witco-Continental at Eunice, N. M., initial output will be SRF (semi-reinforcing) type. Huber will draw its natural gas, key raw material for SRF, from its own supply in the Texas Panhandle.

## Long-Delayed Aluminum Plant Gets Go-Ahead

Harvey Machine Co. is about to start building a $65 million, 108-million-lb. primary aluminum plant at The Dalles, Ore. The government has granted a certificate of necessity permitting fast tax write-off on part of the cost and is expected to assist with loan guarantees and advance payments for production.

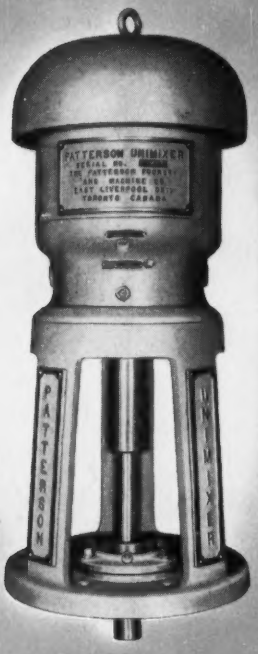
Negotiations for a government go-ahead on this plant have been going on since late 1952. The delay came because, although other aspects of government aid had been worked out, Congress failed to appropriate money for construction of power lines to carry electricity from Bonneville to the plant. Now Harvey gets extra electric power. It also gets extra financial help and the government heads off the firm's threatened $70 million suit for damages allegedly suffered because the government failed to live up to its contractual obligations.



### Hot Cell Handles 10 Million Curies

**This new hot cell laboratory is the first unit completed in the atomic energy research center being built by Battelle Memorial Institute in Columbus, Ohio. It can safely handle large quantities of radioactive material needed to study nuclear fuel reprocessing, radioactive waste disposal, processing of radioisotopes and radiation effects on materials. Above, lead plugs are inserted in access holes and adjustments made in manipulator arms before operating one of the new unit's two cells.**

# BETTER LIQUID MIXING WITH PATTERSON

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Standardized construction for low cost, off-the-shelf availability, UNIMIXER Agitators are furnished in six models for propeller, turbine or other mixing elements. Direct or geared drives handle up to 500 and 2000 centipoises respectively. ½ to 5 H.P.

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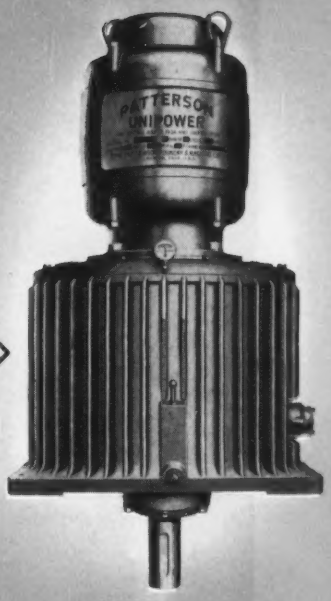
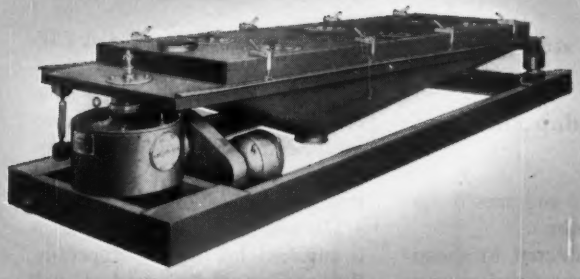
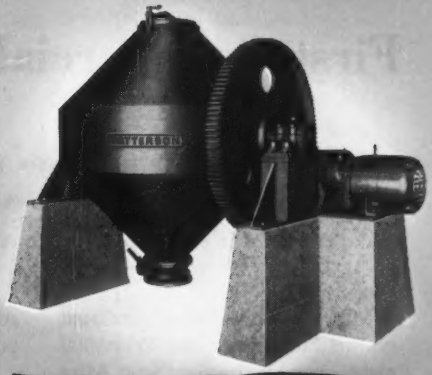



# BETTER DRY BLENDING WITH PATTERSON

## Gyro-Centric Screens



Maximum screening capacity per foot of surface area, high separating efficiency and minimum screen wear are standout advantages of Patterson's Gyro-centric screen action. Many standard and special designs for almost all materials, capacities and desired number of separations.



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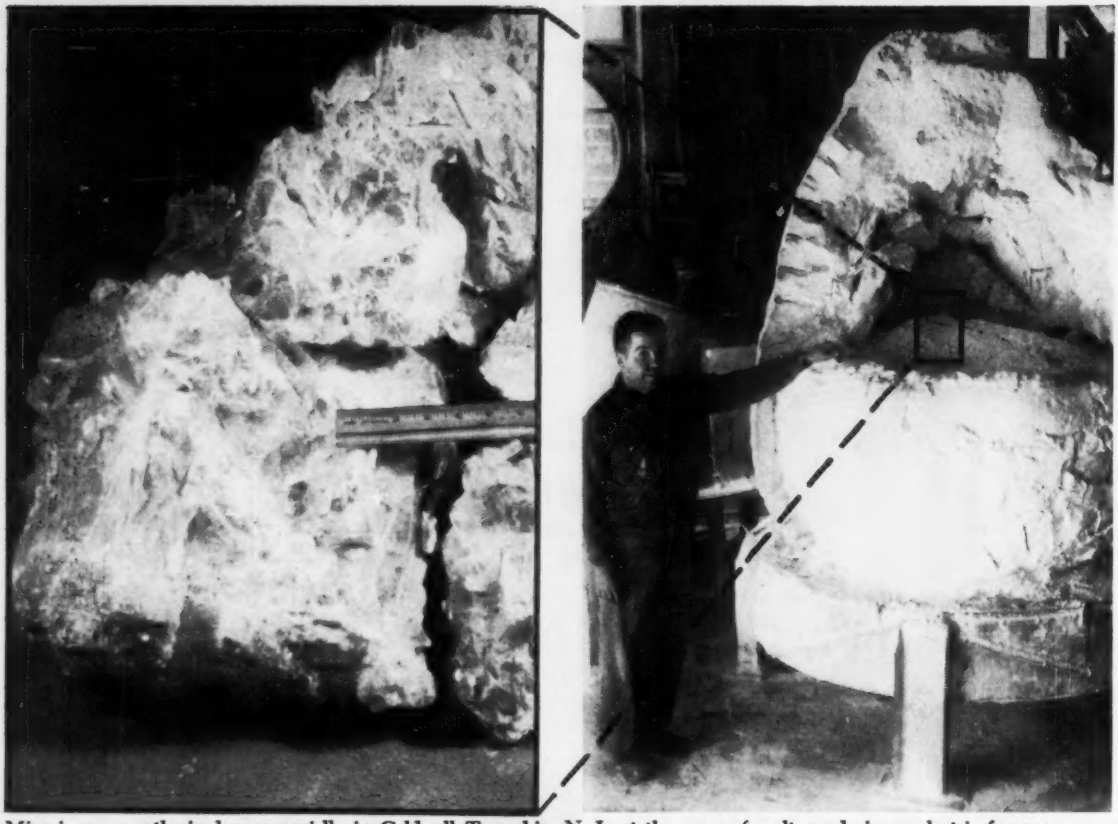


Mica is now synthesized commercially in Caldwell Township, N. J., at the cores of melts made in an electric furnace.

# First Commercial Mica Plant—3-Way Success

- **Synthetic mica supplements natural for strategic use.**
- **It has marked property advantages over natural.**
- **Novel way it's made may prove broadly adaptable.**

Mica is now being produced synthetically in a new $350,000 plant operated by Synthetic Mica Corp. in Caldwell Township, N. J. Geared for five-fold expansion as additional product applications and refinements increase demand, the present one-furnace plant can turn out a 10-ton batch of synthetic mica from a 3-week-long process cycle.

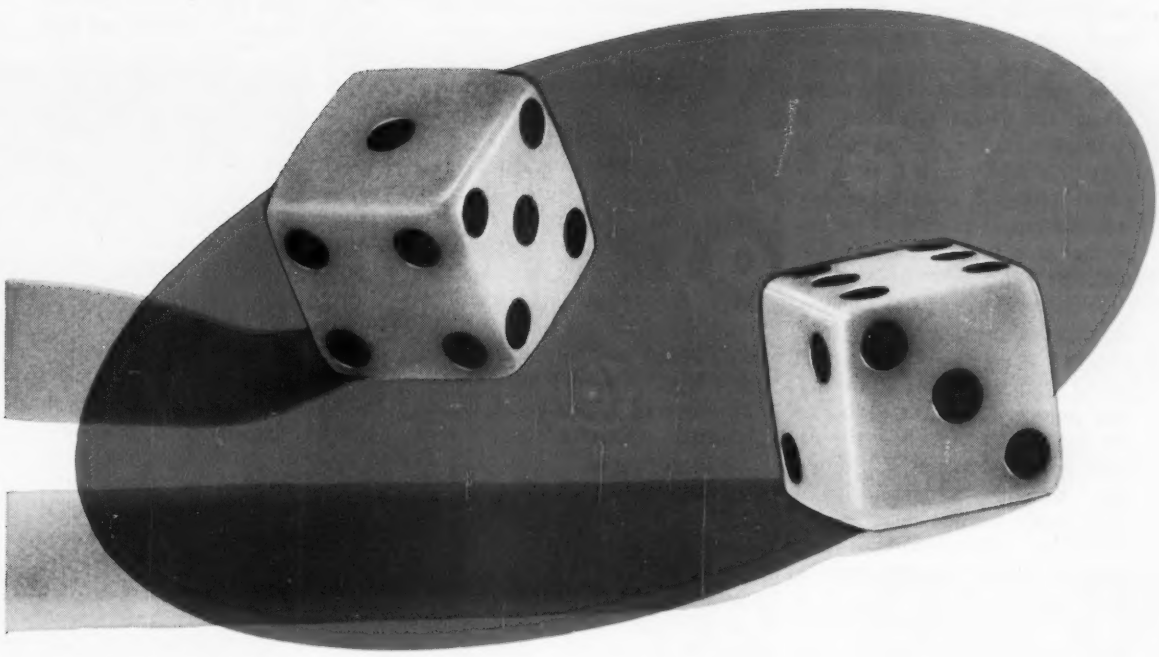
Using inexpensive, readily available raw materials, the plant represents the first commercial-scale step in a long and continuing government-industry effort to find a substitute for scarce, and mostly imported, natural mica.

Of particular interest to chemical engineers is the novel processing principle used in the new plant—that of electrically melting a material with the unmelted portion of the charge serving as the refractory container for the melt. Seemingly simple to the point of crudeness, this processing idea came only after exhaustive search.

Initially, bulk of the new plant's output, in powdered form, will go into glass-bonded mica made by Synthetic Mica's parent company, Mycalex Corp. of America at Clifton, N. J.

**▶Superior Product for a Big Market**—The $30-million U. S. electrical-electronic mica market encompasses a high percentage of strategic applications. Currently, a $20-million share of that market is supplied by India. Hopefully, the new synthetic product will eventually shift the balance and more. Because it is superior to natural mica on such counts as high-temperature resistance and purity, it may create a place for itself in such fields as chemical processing and aviation. The synthetic withstands temperatures of about 800-1,000 C. compared to 500-600 C. for the natural mineral.

Of broad significance is the plant's long-term goal—to produce



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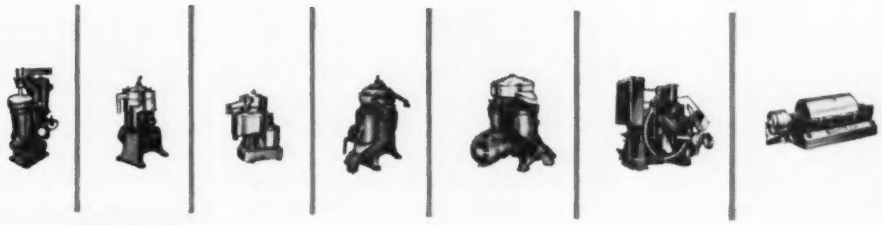

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the synthetic, trade-named Synthamica, in the large-area crystalline sheet form necessary for premium electrical and electronic applications, such as high-grade electronic tubes. The company believes that the availability for the first time of large-scale facilities, both as a research tool and a source of raw material supply, is in itself an important step toward reaching that goal.

Property advantages of the synthetic mica stem principally from the fact that, while it is a true crystallographic analog of the natural micas, it contains a fluorine ion in its molecule where the natural product contains a hydroxyl ion. Because the fluorine ion is more firmly bonded than the hydroxyl ion, synthetic mica is more stable at elevated temperatures.

▶**Deceptively Simple Process** – Called fluor-phlogopite, mica is made at Caldwell Township by electric melting at 2,500 F., in 20-ton batches, of stoichiometric amounts of magnesium oxide, aluminum oxide, silicon dioxide, potassium silica fluoride and potash feldspar. Dry mixed, they are charged to a steel-walled furnace fitted with graphite electrodes. Sixty-cycle current applied to the electrodes starts the melting at the core. In about 7 hr. the resistor burns out, power is increased to 2,000 amp., and current passes through the melt itself, generating heat to maintain melting. Melting is stopped after about 80 hr. and the mass is allowed to cool for 7-12 days. The outside steel shell and unmelted material are removed. A shell of sintered mica powder is cracked away, finally exposing the crystalline pig.

The sintered zone has several important functions. Immediately beneath the melt, it is a good container for the corrosive molten mass. The "igloo" over the top of the melt provides a suitable cover for maintaining the fluorine atmosphere. This need not be a tight vapor seal, since it is necessary to maintain only a partial pressure of fluorine to retain most of it in the melt.

The whole system is essentially self-regulating in that when power input is increased, the melting rate increases without much temperature rise. This is fortunate, because the melt decomposes when it is heated more than 100 C. above its melting point.

▶**Wanted: Bigger Crystals**–The largest crystals produced thus far at the new Caldwell Township plant, though only 9 sq. in. in area by ⅛ in. thick, are about as large as any produced synthetically anywhere. Management at Caldwell Township feels certain that crystal size will be increased by improved methods and formulations as experience is gained with the big furnace.

If consistent production of 4 in. by 4 in. crystals could be achieved, they could find immediate application in radar and television despite a probable cost of $100-200 per lb. For example, higher permissible operating temperature would increase by several fold the efficiency of the newer electron tubes such as the hydrogen thyratron essential to many radar applications. Large synthetic crystals could provide vacuum tube spacers of much higher quality, allowing for the production of much more reliable and better tubes. They are also needed as dielectrics in high-voltage, high-temperature capacitors.

Once the large crystals are produced, however, a major economic obstacle lies in the fact that the coveted sheets of mica, like the natural, come in chunks which must be split apart for use. Part of Synthetic Mica's research effort must be directed towards finding mechanized methods to supersede the present laborious hand processing associated with the production of natural mica in labor-cheap areas like India.

Offering a possible detour around this difficulty is the other known approach to the large-area sheets: reconstituted sheet, or sheet mica made from small flakes. Unlike the natural mineral, synthetic mica can be made to bond to itself. In the resultant sheet, superior thermal resistance of the synthetic is not restricted by the temperature limitations of a binding medium.

▶**Pure Mica Paper**–The flakes are broken into small particles and laid down into a sheet using a technique similar to that used in making paper. Subsequently this sheet is heated under pressure to form a stiff sheet which promises to be a stock suitable for punching intricate, flat insulators. Integrated Mica Corp., Woodmere, N. Y., has achieved notable success along these lines.

The product development laboratory of Sylvania Electric Products used the process on flakes made by Synthetic Mica, then punched experimental sub-miniature tube spacers from the sheet. When installed in tubes, better life test results were achieved at elevated temperatures than was the case with the control lot of tubes made with natural mica. With tube spacers as their primary goal, the Sylvania engineers have been forced to bypass other less rigorous applications for this sheet about which they are enthusiastic.

**Convention Calendar**

**American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit, Nov. 27-30.**

**Ninth Air Conditioning & Refrigeration Industry Exposition, Atlantic City Auditorium, Atlantic City, N. J., Nov. 28-Dec. 1.**

**25th Exposition of Chemical Industries, Commercial Museum and Convention Hall, Philadelphia, Dec. 5-9.**

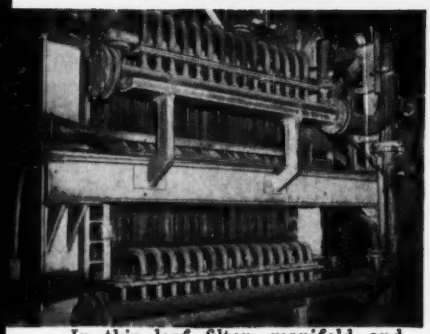
**Nuclear Engineering Congress and International Atomic Exposition, Public Auditorium, Cleveland, Dec. 10-17.**

**Society of Plastics Engineers, twelfth annual conference, Hotel Statler, Cleveland, Jan. 18-20.**

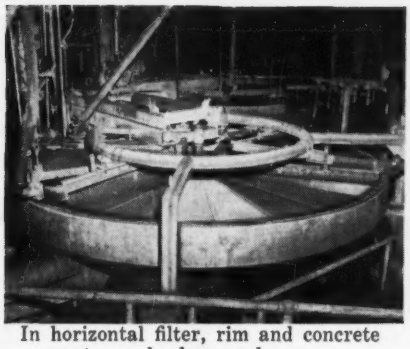
**Seventh Plant Maintenance & Engineering Show, Commercial Museum and Convention Hall, Philadelphia, Jan. 23-26.**

**Canadian Pulp and Paper Assn., technical section, annual meeting, Mount Royal Hotel, Montreal, Jan. 25-27.**

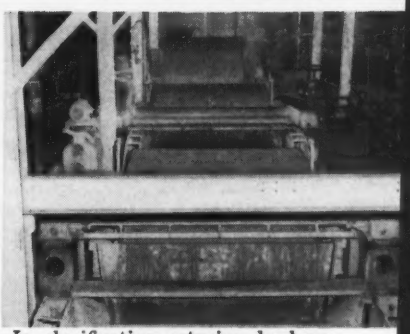
# "We rely on lead at every stage of acid handling" says large chemical processor



In this leaf filter, manifold and plates are lead

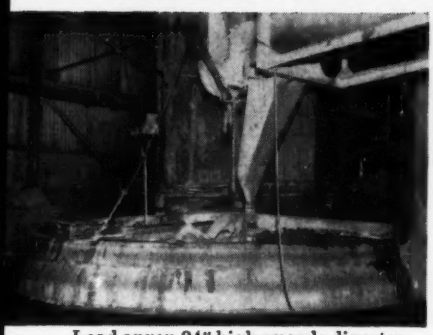


In horizontal filter, rim and concrete supports are lead-covered

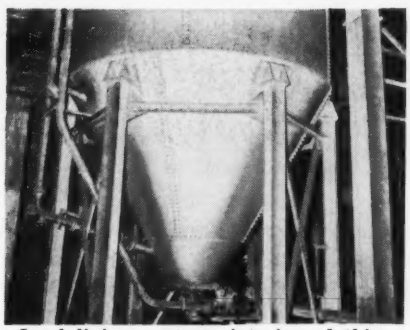


In clarification rotaries, lead protects parts exposed to acid

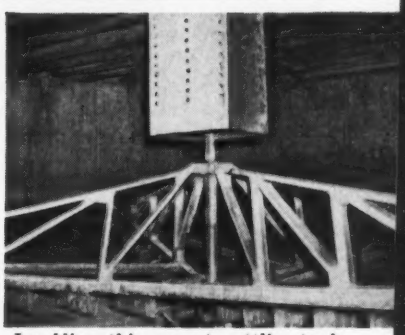
## "...in our filters



Lead apron 24" high guards digester rim against spill

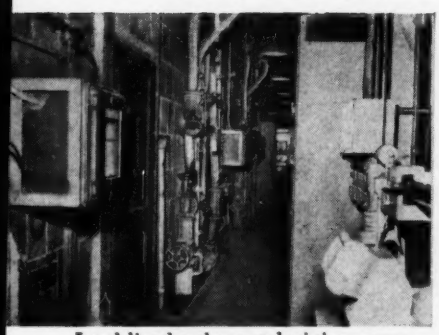


Lead lining protects interior of this steel digest tank

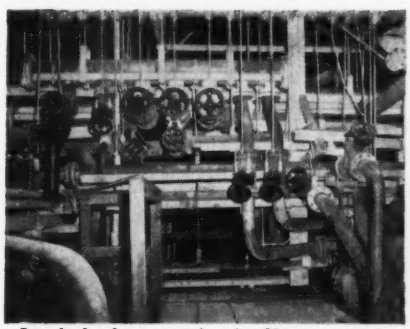


Lead lines this concrete settling tank, covers rake. Plows are solid lead

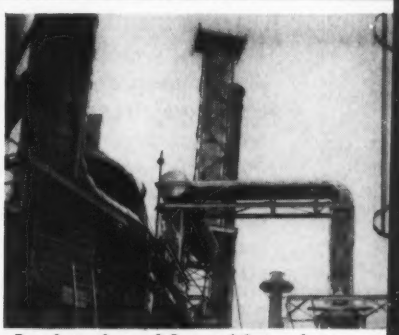
## "...in our tanks



Lead-lined valves and piping serve digesters



Lead checks corrosion in filter control valve station



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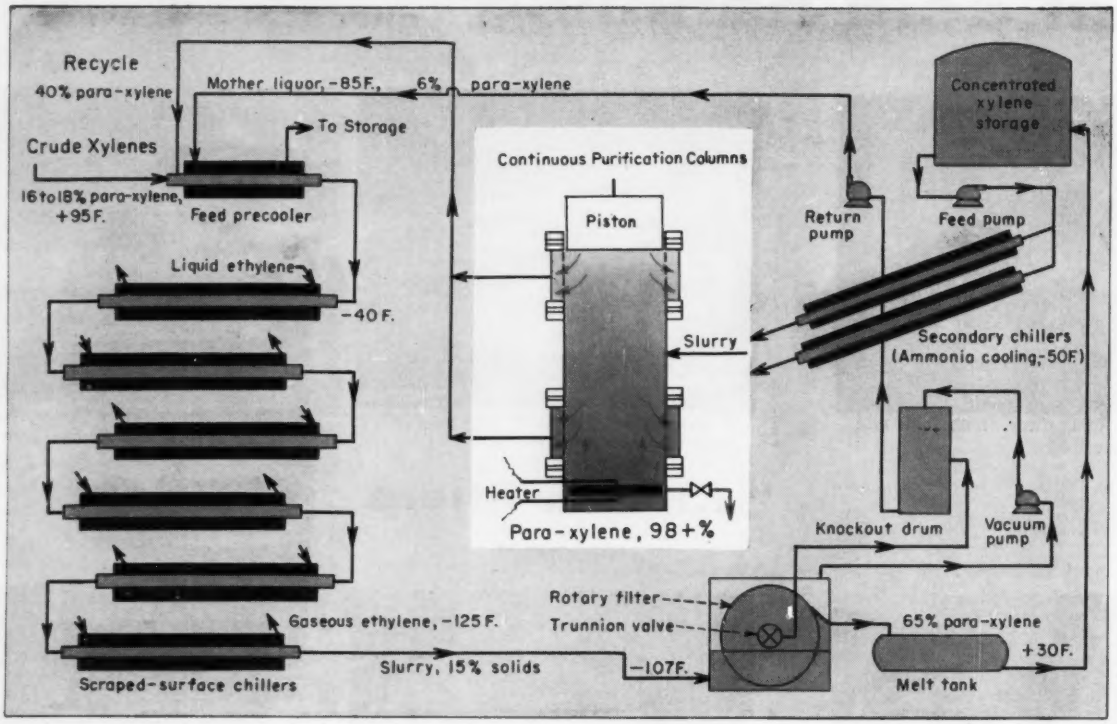



PHILLIPS' PARA-XYLENE PROCESS in commercial production at Big Spring, Tex.

# First Details on New Separation Technique

**Continuous fractional crystallization, as developed by Phillips Petroleum, offers a promising way to perform difficult liquid separations.**

Phillips Petroleum Co. early last year commercialized the first truly continuous fractional crystallization operation. In a 5-million-lb./yr. plant near Big Spring, Tex., the new technique is being applied to the separation of high-purity para-xylene from crude mixed xylenes.

Although this is the only known application today, continuous fractional crystallization as a new separation technique promises to find numerous uses in chemical and petroleum processing for making difficult separations of liquids.

The plant—operated by the subsidiary Phillips Chemical Co.—receives crude feedstock from Cosden Petroleum Co.'s adjacent refinery. Feedstock contains 16 to 18 percent para-xylene, mixed with ortho-xylene, meta-xylene and ethyl benzene. This poses a difficult separation problem.

▶**A Bet Pays Off**—Distillation is out because of the narrow range of boiling points—about 10 F. between para- and ortho-xylene; only 1.4 F. between para- and meta-xylene.

But freezing point differences offer something to work with. The difference between para- and meta-xlyene is about 110 F., from +55.9 F. to −54.2 F. respectively.

Para-xylene is the desired product. As a starting material in the synthesis of Dacron polyester fiber and other terephthalic acid esters, it is finding ever-increasing markets. Predicted U.S. demand in 1960 will be 100,000,000 lb./yr.

While other manufacturers of para-xylene have relied on two-stage batch crystallization, Phillips has gambled on the use of continuous crystal purification columns. After many years of research and pilot-plant work, and after two years of commercial operation, it appears that Phillips has won its bet.

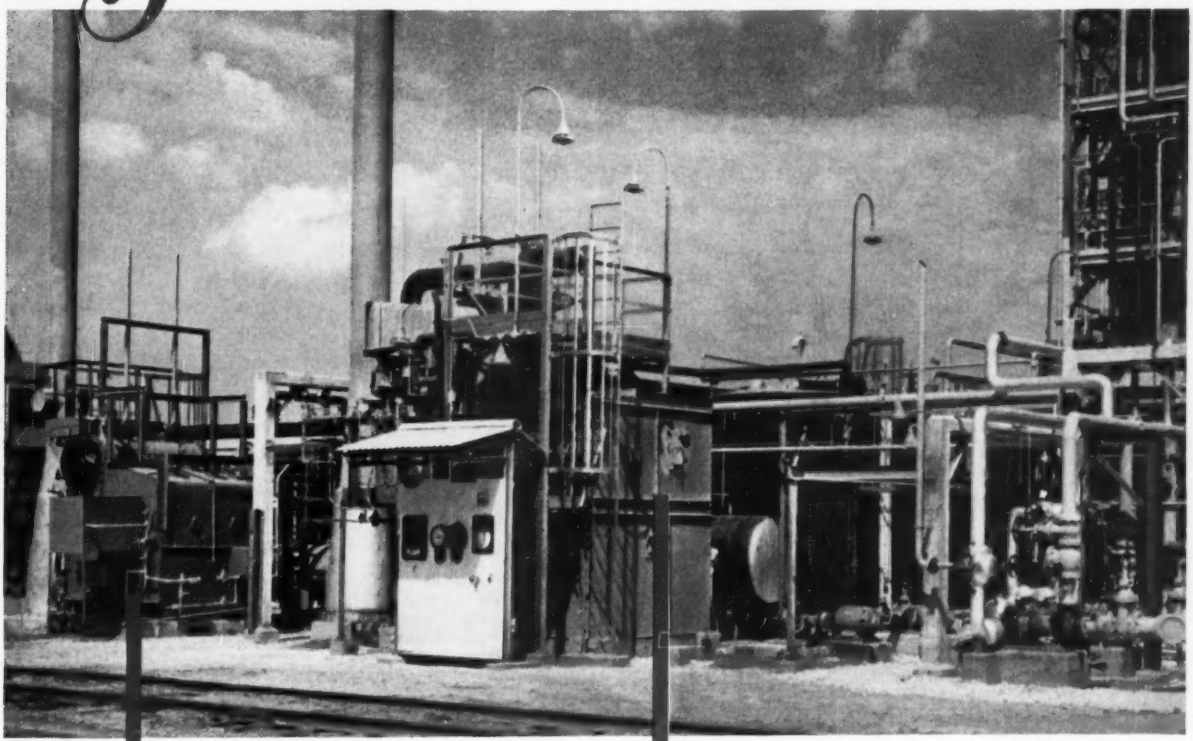
In any event, Phillips is now willing to take some of the wraps off its process.

▶**Like Soft Ice Cream**—Key to success is the crystal purification step.

First the para-xylene content of the process stream is built up to 65% by a primary chilling-crystallization and filtration. Then the concentrated xylenes cool to about zero F. in a second bank of scraped-surface chillers.

This produces a thick crystal

# *at* Jefferson *Chemical Company's Neches Plant*

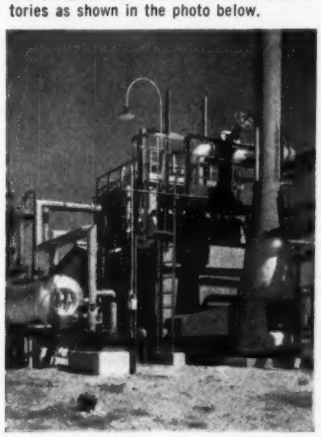


# FW 3,700,000 BTU DOWTHERM UNIT

## puts the heat on

## Ethylene Oxide—Ethylene Glycol Production

This 2,300,000 btu Dowtherm unit by Foster Wheeler served the original ethylene oxide-glycol unit at Neches. After this was expanded, the 3,700,000 btu unit went on line, and the smaller Dowtherm vaporizer was removed and installed at Jefferson's Austin Laboratories as shown in the photo below.



Here, at the Neches plant of the Jefferson Chemical Company, large amounts of heat, at closely controlled temperatures, are required for the quality and quantity production of ethylene oxide and ethylene glycol.

All high-temperature, low-pressure heating requirements at this Jefferson plant are supplied by the 3,700,000 btu Dowtherm unit shown above — designed, built and installed by Foster Wheeler.

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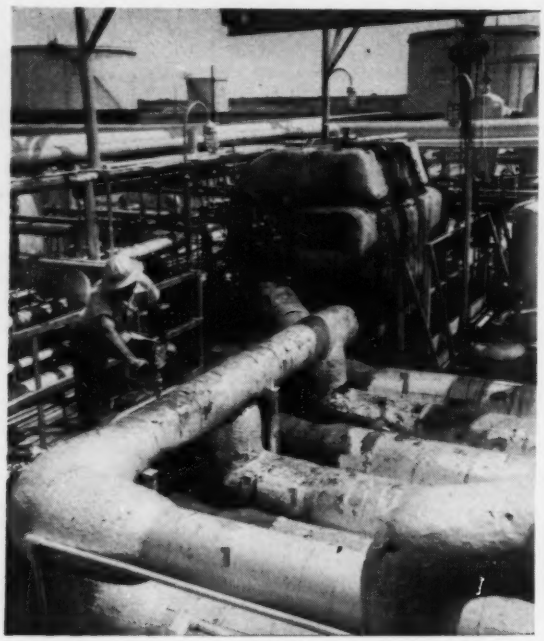
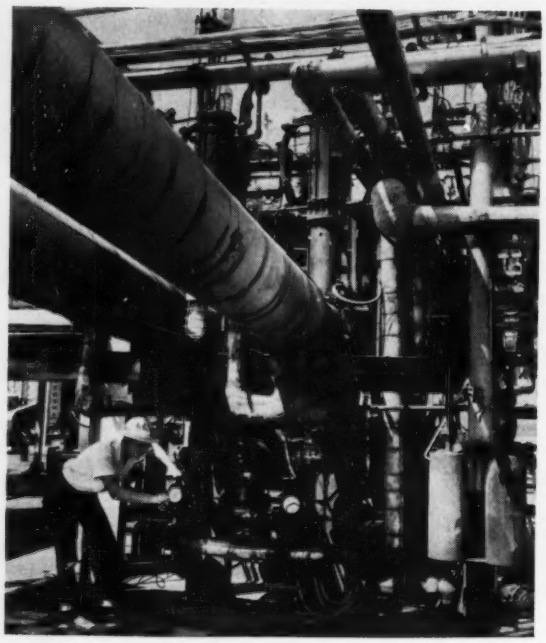


1 Primary chillers
2 Rotary filter



3 Secondary chillers
4 Purication columns

slurry much like soft ice cream. From the chiller, the slurry enters the crystal purification column. Here a piston at the top of the column compresses the slurry into a compact crystal bed.

Impure liquid in the slurry feed squeezes out and passes through filters built into the column wall. At the same time, the piston pushes the crystal bed down onto an electrical pancake heater at the bottom of the column. The heater melts the lower surface of the crystal bed and yields the liquid para-xylene product.

▶ **Reflux Returned**—Product flows from the base of the column through a back-pressure regulating valve. By holding a pressure on the liquid in the column base, some of the pure liquid product is forced back up through the descending crystal bed and flows out through the filters in the column walls.

In effect, the upflow of pure product performs the same function as reflux in a distillation column. There is a concentration gradient along the column. Liquid sidestreams are drawn off toward the top of the column while progressively purer product—first in solid and then in liquid form—flows down the column.

As a result of the countercurrent action, crystals of 98.0% para-xylene can be produced continuously just above the pancake heater. Column performance depends on the adjustment of several operating variables. Routine production runs about 98.5% para-xylene but with suitable adjustments, 99% purity or better can be obtained.

▶ **Other Process Steps**—In addition to the unique fractional crystallization operation, other process steps used by Phillips differ from other plants that make para-xylene. For example, no special precautions are needed to insure the formation of large crystals.

A feed pump blends recycle xylenes, containing approximately 40% para-xylene, with refinery crudes (16 to 18% para). Combined feed to the process is about 20% para-xylene.

Precoolers bring the feed to −40 F. by heat exchange with cold concentrated xylenes from the melt tank and rotary filter (*see flowsheet*).

▶ **Ethylene Refrigerates**—From the precooler, the crude xylenes pass through six 6-in. I. D. scraped-surface chillers. Here boiling ethylene at −125 F. refrigerates them to −107 F. Approximately 75% of the para-xylene in the feed freezes out.

This gives a slurry containing about 15% solids; hence the need for scrapers inside the chillers. Without scrapers, the crystals would soon plug the chillers.

Cooling xylenes below minus 107 F. would allow either meta- or ortho-xylene to freeze out, depending on the feed composition. And this must be avoided. The crystal slurry continues to the rotary filter for preconcentration.

▶ **Rotary Filter**—A cloth-covered segmented drum provides a rotary filter surface. By alternate application of vacuum and air through a trunnion valve, a dry cake of 60 to 65% para-xylene can be removed at the scraper blades.

The blades guide the cake down the crystal hopper into the melt

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tank. The filter cloth slowly fouls with tiny crystals and is washed when necessary by spraying hot mother liquor over the filter drum for several revolutions.

Dry air is the circulating gas through the filter and vacuum equipment. A tight system is a must. Otherwise moisture in the air would freeze out and foul the filter cloth.

Mother liquor from the filter and from the vacuum tanks is pumped to the feed precoolers, as mentioned above, and returned to the refinery.

▶ **Secondary Chilling**—The crystal cake of concentrated xylenes falls into the melt tank, where the temperature is maintained at 30 F. From the melt tank, concentrated xylenes circulate on level control to the concentrated xylene storage tank.

The feed pump for the continuous crystal purification columns circulates the concentrated xylenes in the storage tank to maintain a uniform feed to the columns.

Circulation rate is set to maintain a pump discharge pressure of 40-50 psig. At this pressure the process stream flows to the two scraped-surface chillers (ammonia refrigeration) that feed the continuous purification columns.

So far, Phillips hasn't had to push the columns. Para-xylene purchasers don't expect more than 98% purity. But Ross Thomas, vice president of research & development for Phillips, confidently expects to be able to turn out 99.5% product or better when a demand develops.

## New Char Plant To Use Low Grade Coal

Koal-Krudes, Inc. of Spokane has been organized to recover coal char and creosote from low grade coal in a $200,000 plant planned for Monarch, Wyo. The plant will consume 250 tons of coal daily.

Process to be used has been tested in a one-ton-per-hour pilot plant at Montana State College. It is owned by PDP Co. of Lewiston, Idaho, a Koal-Krudes affiliate.

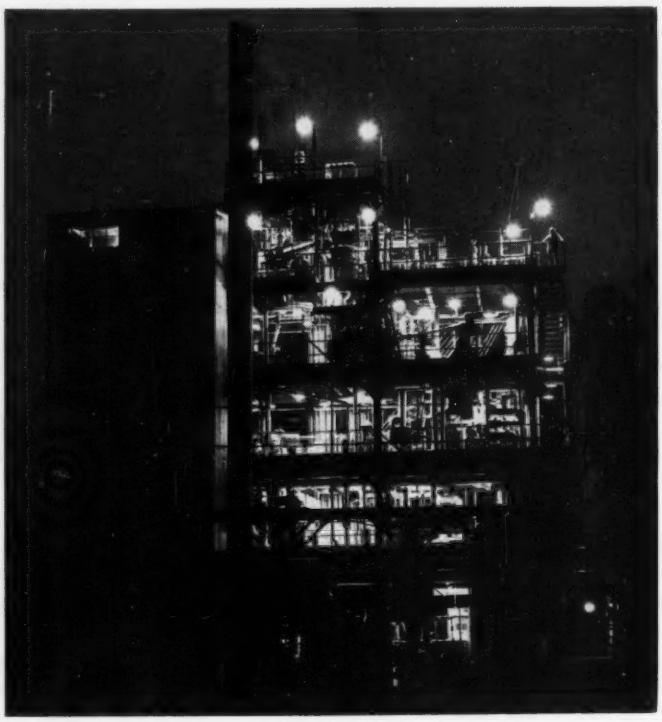
The second commercial (though small-scale) low-temperature coal carbonization plant announced in recent months, it joins Cotarco, Inc.'s $11.5 million unit which will process 8,520 tons daily in Colorado (*Chem. Eng.*, May 1955, p. 134).

## New Process for Low-Grade Uranium Ore

First commercial use of a new method for processing low-grade uranium ores is planned for a mill authorized at Maybell, Colo., by the Atomic Energy Commission.

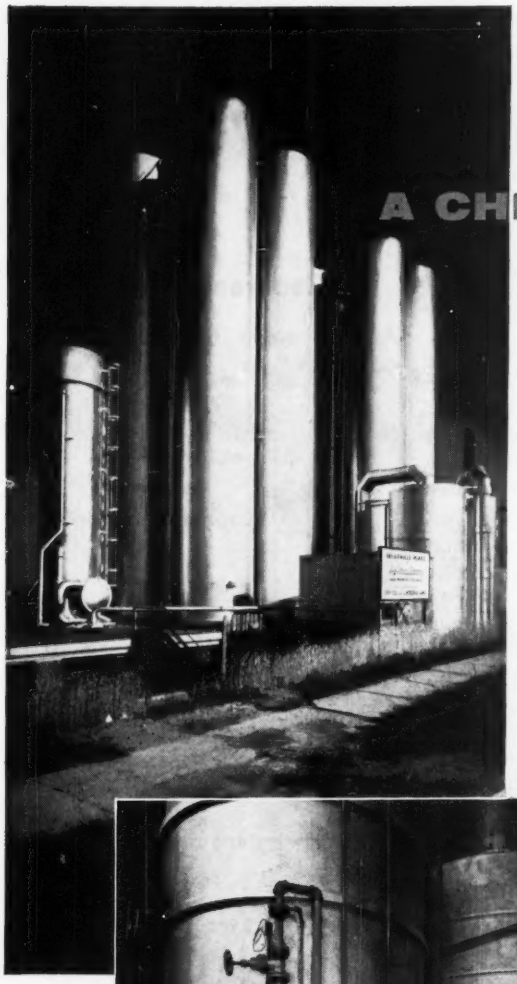
The $1 million mill will place low-grade ores directly under percolation leaching to extract the uranium concentrate. Other mills on the Colorado Plateau handle uranium-vanadium ores. They are salt-roasted first and then subjected to percolation leaching to obtain both vanadium and uranium. The percolation process used for uranium works very much like the familiar coffee-making process.

The Maybell mill, to be operated by Trace Elements Corp., will process low-grade ores produced in northwestern Colorado. A pilot plant now under construction will furnish data for completion of the larger mill late in 1956 or early 1957.



**Open Air Plant Makes New Polyester Film Base**

**Unique in the photographic film manufacturing field, this five-story open air structure houses chemical mixing and formulation of a new polyester film base at Du Pont's full-scale plant recently completed at Parlin, N. J. A single instrument board monitors much of the plant's operation. Formerly made in pilot plant, the base excels in durability and dimensional stability. Eastman Kodak Co. has just been licensed to manufacture the base under Du Pont patents.**



# A CHEMICAL PLANT NEEDS . . .

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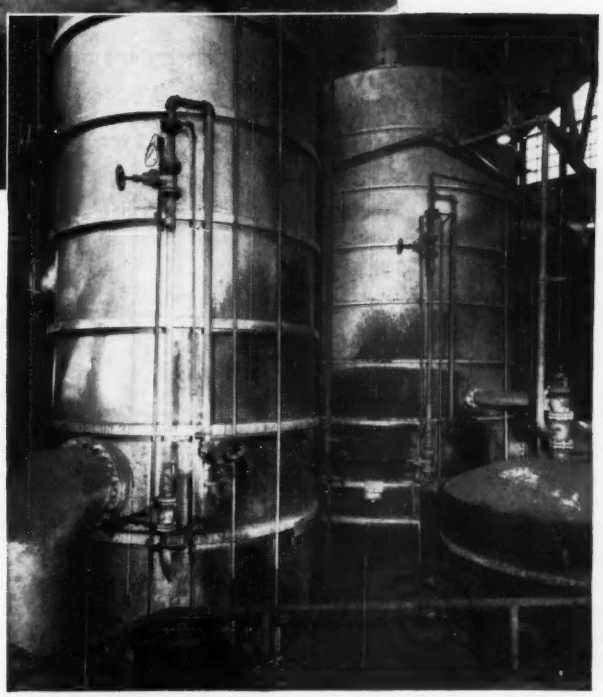
**PRESSURE VESSELS**

**FLAT BOTTOM TANKS**



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Top left: Eight 12-ft. diam. by 100-ft. carbon dioxide towers fabricated and erected by CB&I.

Left: Conkey all nickel construction Triple Effect Evaporators producing 50 per cent caustic liquor.

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# New Sulfite Pulp From Pine . . . Cuts Pollution

**Pine becomes usable for sulfite pulp in modified process now operating. At same time, new recovery process recycles chemicals, cuts stream pollution.**

A number of U. S. pulp and paper companies are investigating a new Swedish pulping process to see what promise it offers in solving American raw material and stream pollution problems.

The new process, in operation since April and announced publicly for the first time in September,* produces a high-quality sulfite pulp from pine pulpwood. And it avoids stream pollution by processing the sodium-base pulping liquor through a new system that returns chemicals to the digesters.

▶ **Mill Operating**—Full output of the 120-ton-per-day sulfite pulp mill of Stora Kopparbergs Bergslags AB, Skutskar, Sweden (U. S. office 230 Park Ave., New York 17, N. Y.) now comes from pine by this process.

Stora Kopparbergs swung to pine at Skutskar to free spruce pulpwood for expansion of newsprint capacity at another of the company's mills. Added impetus came from a pulpwood price differential favorable to pine.

Solution of pine sulfite pulping problems has been sought by Stora Kopparbergs and others for 30 years or more. What finally brought successful commercialization was a new two-stage process based on highly soluble sodium bisulfite.

At Skutskar, the process makes a strong, unbleached sulfite pulp that is clean with good color and low resin content. What interests U. S. engineers is that the process can be modified to satisfy local conditions of wood supply, mill equipment, pulp quality and chemical recovery.

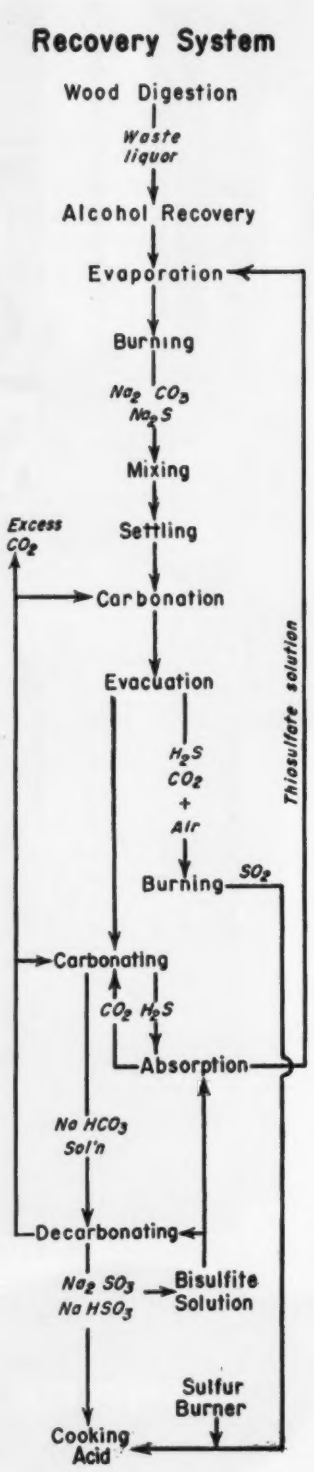
▶ **Potential in U. S.**—Preliminary U. S. interest may slant toward applying the recovery aspects of the process to existing sulfite mills because of public pressure to overcome pollution problems. Any steps taken in this direction would, of course, be predicated on changing over to sodium-base pulping.

The potential for converting U. S. mills to pulping of pine is less clear cut. Stands of red pine, comparable to the Scandinavian Norway pine, are found to some extent in the Northeast and Great Lakes regions of the U. S. But very rough preliminary estimates fail to indicate whether this supply is sufficiently concentrated in the proper locations to benefit existing mills. Still, the versatility of the process may point eventually to other types of pine as sources of pulpwood.

At present, the sulfate process predominates in new capacity for pulping softwoods in the U. S. Since sulfate pulp has moved into many sulfite markets, new sulfite expansion has virtually halted. Thus, for now there appears little likelihood that even a new process would stimulate construction of new sulfite mills.

▶ **Why Pine Is Difficult**—Pine cannot be pulped by conventional sulfite process because the pulping liquor fails to free the fibers in the heartwood. When the wood is heated phenolic compounds in the heartwood condense with lignin to form insoluble materials. The reaction is catalyzed by hydrogen ions present in conventional sulfite liquor. Thus, sulfonation and dissolving of the lignin are hindered.

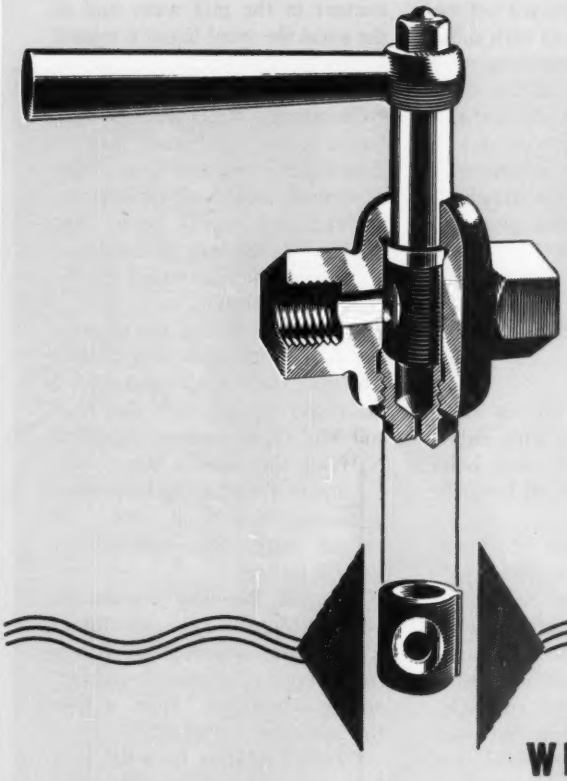
Furthermore, natural resin in the heartwood slows down impregnation of cooking acid into the wood. Acid components of the




* By Dr. Ragnar Soderquist, Managing Director, Stora Kopparbergs Bergslags AB at VIth Congress of Scandinavian Paper Engineers, Helsinki, Finland.

# IN RESISTING GREAT PRESSURES

## tightness tells



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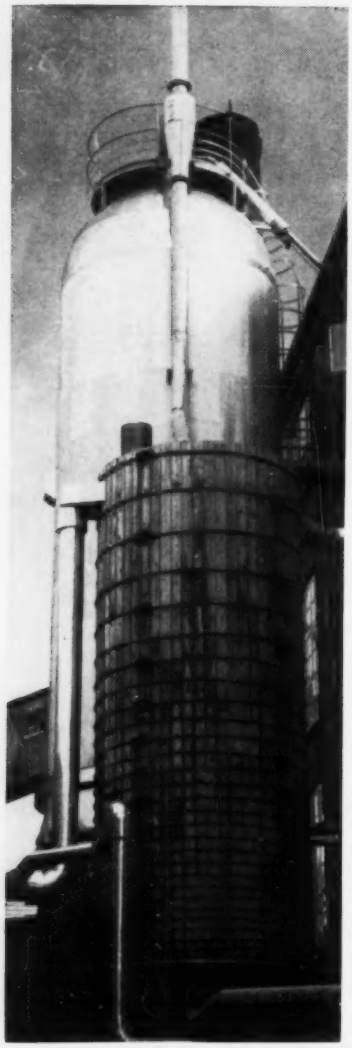

TANK for drawn-off pulping liquor.

liquor impregnate the wood selectively making the condensation reaction proceed faster than the sulfonation.

▶ **Overcomes Barriers**–Stora Kopparberg's process is designed to speed up impregnation greatly. To reduce the catalyzing effect of acid, the pH is kept above 4 so that the bisulfite-lignin reaction proceeds much faster than the phenol-lignin reaction. This balance between reaction rates is tipped conclusively in favor of the bisulfite-lignin reaction by maintaining a high concentration of bisulfite ions.

However, the desired level of bisulfite ions cannot be reached when using a calcium-base pulping liquor. In mill practice, sodium base has given the highly soluble bisulfite needed for good pulping.

Sodium bisulfite solution partially sulfonates the lignin in the pine heartwood, leaving ligno-sulfonic acid fixed in the carbohydrates of the wood. By continued sulfonation and acid hydrolysis with sulfur dioxide or $SO_2$ solution these acids can be dissolved out of the wood.

▶ **How Mill Operates**–At Skutskar, the pine sulfite mill operates in conjunction with a sulfate mill. Because of this only the straightest wood above 5 in. thick goes into sulfite pulp; the rejects go to the sulfate mill. To assure a very clean raw material the outer 10-20% of sapwood is peeled off during barking and also sent to the sulfate mill.

Wood is cooked in six 5,300 cu. ft. digesters lined with carbon brick. A 6,000 cu. ft. tank holds cooking liquor drawn off from the digesters.

At the present time recovery of sulfite chemicals is combined with recovery of sulfate chemicals because of a temporary economic advantage due to local conditions. Thus cooking acid now is made up from sodium hydroxide and $SO_2$.

A mixture of preheated fresh cooking acid and recycled acid from a previous cook are fed to the digesters. Cooking is started at a relatively high temperature and the chips are given a good impregnation. Most of the liquor in the digester is drawn off and liquid $SO_2$ is introduced for the second or hydrolysis stage. Hydrolysis is completed after total net cooking time for the two stages has reached 10 hr.

Sulfur dioxide released from the digester is recovered as a liquid.

Following washing in diffusers the pulp is treated with sodium hydroxide to lower resin content from 4% to less than 0.5%. This assures a uniform final product and eliminates possibility of pitch troubles during the screening and drying operations.

Liquor removed from the pulp in the diffusers contains about 20% solids. After sugar is removed in the sulfite alcohol plant, the liquor is concentrated to 52% total solids in triple-effect pressure evaporators. Steam from the last effect goes to the first effect of a vacuum evaporator working on sulfate black liquor.

Because of the high calcium content in the mill water and in the wood the spent liquor is treated to remove calcium before evaporation.

▶ **Chemicals Recovered**–Concentrated liquor is burned in the Tomlinson furnace to give a melt containing roughly equal amounts of $Na_2S$ and $Na_2CO_3$, with some $Na_2SO_4$. Combustion gas is stripped of $SO_2$, which is returned to the sulfite $SO_2$ makeup.

Prior to combining the recovery operation with the sulfate mill, $CO_2$ from the lime kiln and alcohol plant was reacted with the $Na_2S$ and $Na_2CO_3$ to produce crystalline $NaHCO_3$ and gaseous $SO_2$. Cooking liquor was made up from these materials. Inevitable losses of sodium salts were replaced by sodium sulfate.

▶ **Improved Recovery Scheduled**–Now scheduled for the near future is a new chemical recovery system with improved economy and operating advantages. Here is how the process will operate.

Clarified solution from the alcohol recovery unit is carbonated with 100% $CO_2$ from the decarbonating tower. Absorption by the solution is held to a low level to prevent crystallization of $NaHCO_3$.

Under vacuum the solution is warmed slightly to drive off about 90% of the sulfur as $H_2S$ together with some $CO_2$. The $H_2S$ is burned to $SO_2$ for process.

The liquid stream that still contains some sulfur as sulfide is met by a stream of $CO_2$. The $Na_2CO_3$ is thereby transformed fully into bicarbonate. All sulfur is carried off as $H_2S$. The bicarbonate solution then is sufficiently pure to be used, without risk, for making up the sulfite cooking acid.

Leaving the tower the stream of $CO_2$ containing $H_2S$ is met by bisulfite or $SO_2$ solution that completely transforms the $H_2S$ into

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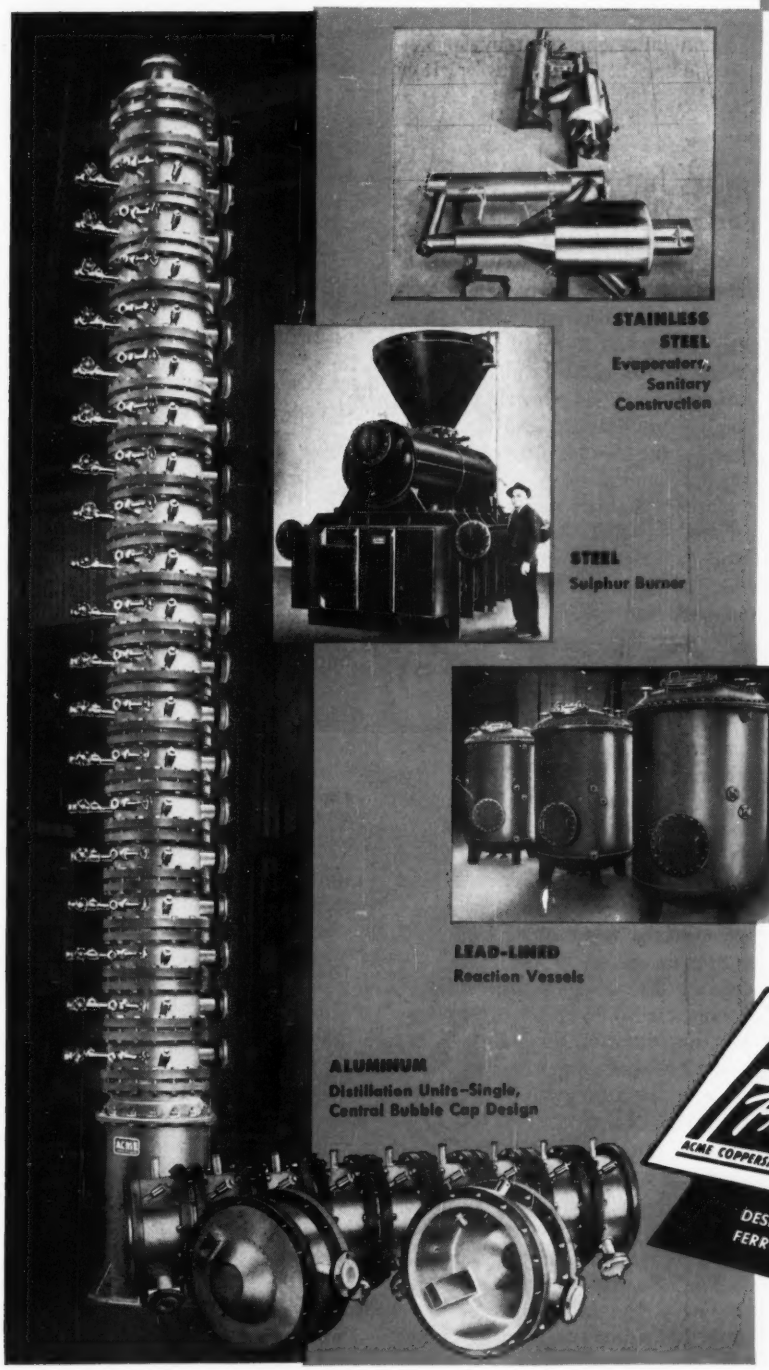

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thiosulfate. The purified $CO_2$ recycles in the recovery system.

Thiosulfate solution returns to the evaporators. Evaporator discharge, of course, is feed for the Tomlinson furnace where all forms of sulfur are reduced to sulfide.

▶ **Balance Sheet**—Dr. Soderquist reports that the Skutskar mill shows good financial gain in changing from calcium base spruce to sodium base pine sulfite process. Although some costs are higher due to the evaporation, burning and recovery operations, these are more than offset by lower wood cost, lower wood consumption and lower steam cost for cooking and evaporating. Based on Swedish experience Dr. Soderquist is confident that the process offers major advantages to American sulfite pulpers.

## Four Firms Plan Big Expansions for Rubber

Not content merely to run the synthetic rubber facilities they bought from the government this year, four more firms, Firestone Tire & Rubber, Goodrich-Gulf Chemicals, Inc., Phillips Chemical and Petro-Tex Chemical Corp. are building new plants. Like other recently announced plans in rubber (*Chem. Eng.* Oct. 1955, p. 104), these are designed to meet big demand increases expected by 1960.

Integrating back to raw materials, Firestone will build its first butadiene plant—40,000 tons/yr. capacity, no location specified. The firm also says it will boost its Akron, Ohio, synthetic rubber capacity by 35%—to 40,000 tons/yr.—and previously announced that it was increasing GR-S capacity at Lake Charles, La., to 150,000 ton/yr., up 50%.

First step in Goodrich-Gulf's expansion program is installation of facilities at Port Neches, Tex., capable of turning out 18,000 tons/yr. of latex rubber (used mainly in foam rubber). Initial production will be held to a third of capacity. Farther off are expansions in butadiene and GR-S. The company's output of both is at maximum capacity and engineering surveys on possible expansions are now being studied.

Phillips is expanding its copolymer capacity at Borger, Tex., by 22%. (This is in addition to previously announced plans for a 15% boost there.)

Petro-Tex, owned jointly by Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp., will increase capacity of its Houston butadiene plant by 50% over the present 90,000 tons/yr. It should be completed next year.

## Big Coal Producer Enters Chemical Field

With a cresylic refinery now under construction at Newark, N. J., the nation's largest soft coal producer enters the chemical field and cashes in on some results of its coal-carbonization research. Pittsburgh Consolidation Coal Co. has acquired the Newark plant of Reilly Tar & Chemical Corp., is building some new facilities and renovating certain old ones. The completed plant, representing a total investment of $3-3.5 million, will use a company-developed process to produce new high quality grades of cresols, cresylic acids, phenol, resins and molding powders.

To be operated by a newly formed subsidiary, Pitt-Consol Chemical Co., the plant will feed primarily on petroleum refinery waste streams. But it will also provide an outlet for the most valuable liquid fractions from coal carbonization plants. These liquids are expected to form the basis for future expansion of the chemical refining operations because a new commercial process for low temperature carbonization, also company-developed, promises to produce an increasing supply of this raw material.

Until mid-1956, while the new facilities are under construction, part of the old plant will continue to produce present grades of cresylic acids and molding powders.

The Newark plant was built originally to process tars derived from eastern coke plants used in gas-making. When the influx of pipelined natural gas curtailed supplies, Reilly made a start in converting to petroleum-based feed. However, the company is primarily in the coal tar chemical business and, with the transfer of the Newark plant to Pitt-Consol, will concentrate its operations in the Midwest where it has 15 plants.

### News Briefs

**Chlorides:** Stauffer Chemical Co. plans a multi-million dollar plant at Louisville, Ky., for carbon tetrachloride, chloroform, methylene chloride and anhydrous hydrogen chloride. Completion: 1957.

**Fiber:** Carbide and Carbon Chemicals Co. has started a 35% expansion in dynel capacity at South Charleston, W. Va.

**Petroleum:** Standard Oil Co. (Ind.), because of the severe fire at its Whiting, Ind., refinery, will build a new 14,000 bpd. Ultraformer there immediately instead of waiting until 1957 as had been previously planned.

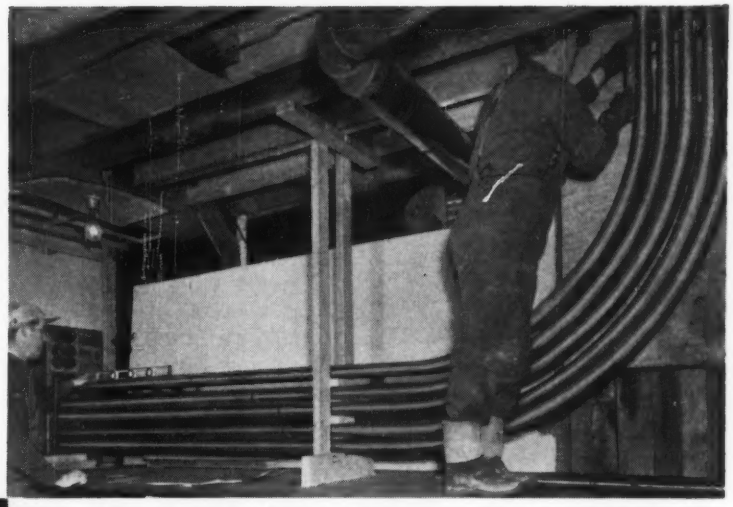
**Polystrene:** Dow Chemical Co. is building a new plant at Torrance, Calif., for expanded polystrene.

**Ammonia:** Southern Nitrogen Co. has completed financing for a $14 million plant at Savannah, Ga., which will make 250 tons/day of ammonia for nitrogen solutions and prilled ammonium nitrate.

**Phthalic Anhydride:** Pittsburgh Coke & Chemical is doubling its phthalic anhydride capacity by building a $3 million unit at Neville Island, Pa. And Monsanto Chemical Co. has started building a $1.4 million phthalic plant in Wales, England.

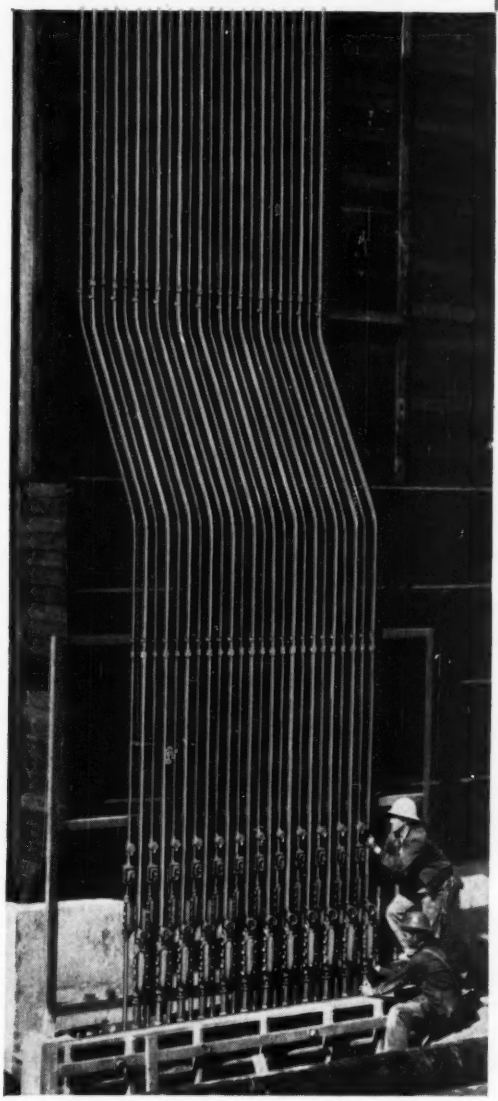
**Phenolics:** Durez Plastics Div. of Hooker Electrochemical Co. is now operating a new $5 million phenolic molding compounds plant at Kenton, Ohio.

**DOWN** a humid 180 feet below water level at Downsville Dam



Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.

**UP** in the corrosive air at a water cooling tower



During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

# EVERDUR Conduit will guard the electric power lines—for years

**Everdur* Never Rusts.** It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

**Everdur is Tough.** In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

**Everdur is Nonmagnetic.** Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses —R.C. in nominal sizes from ¼" to 4", inclusive, and E.M.T. in nominal sizes ⅜" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

85120

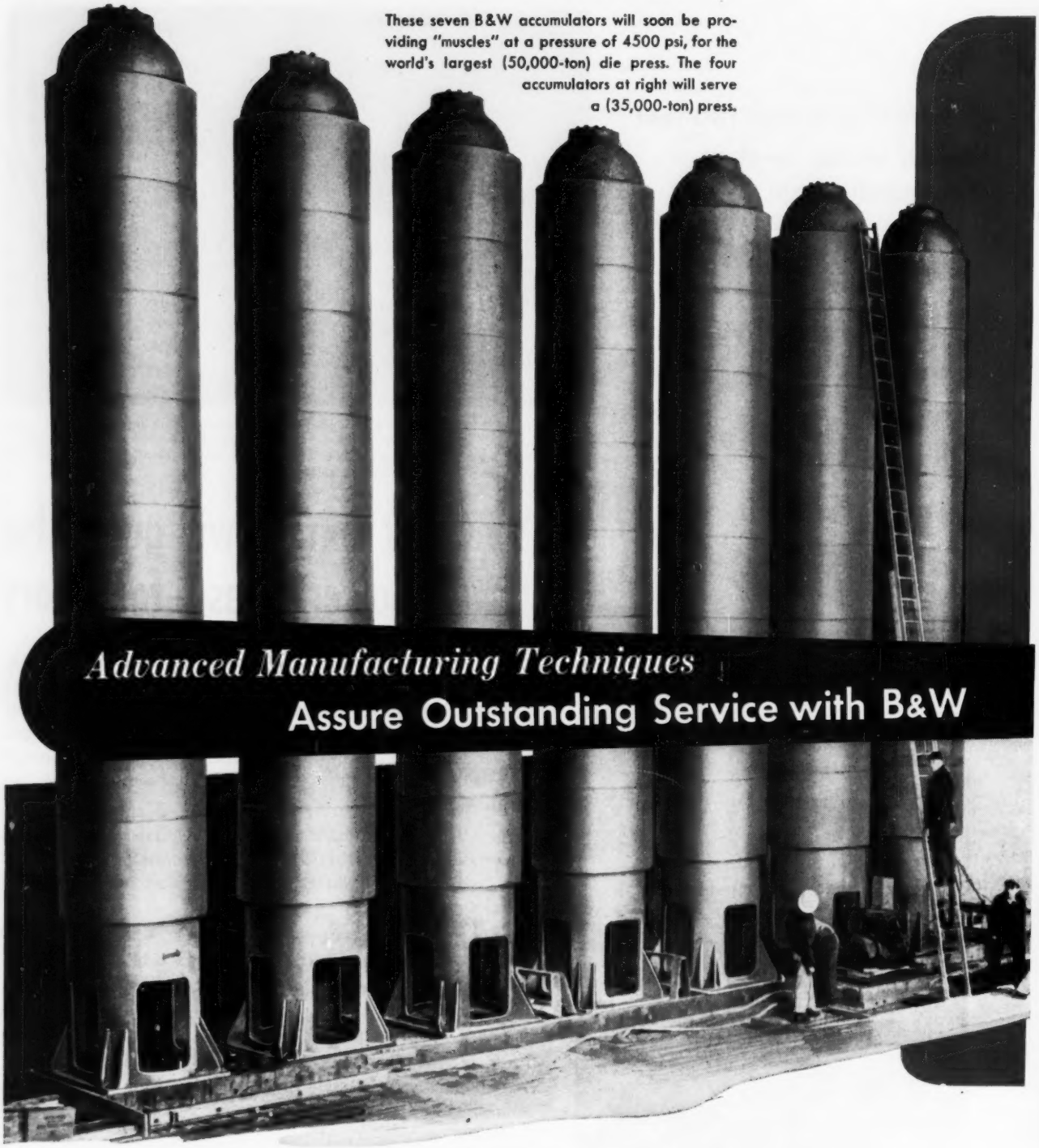
*Reg. U. S. Pat. Off.

**EVERDUR ELECTRICAL CONDUIT**

**ANACONDA®**

**COPPER SILICON ALLOYS**

**CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE**



These seven B&W accumulators will soon be providing "muscles" at a pressure of 4500 psi, for the world's largest (50,000-ton) die press. The four accumulators at right will serve a (35,000-ton) press.

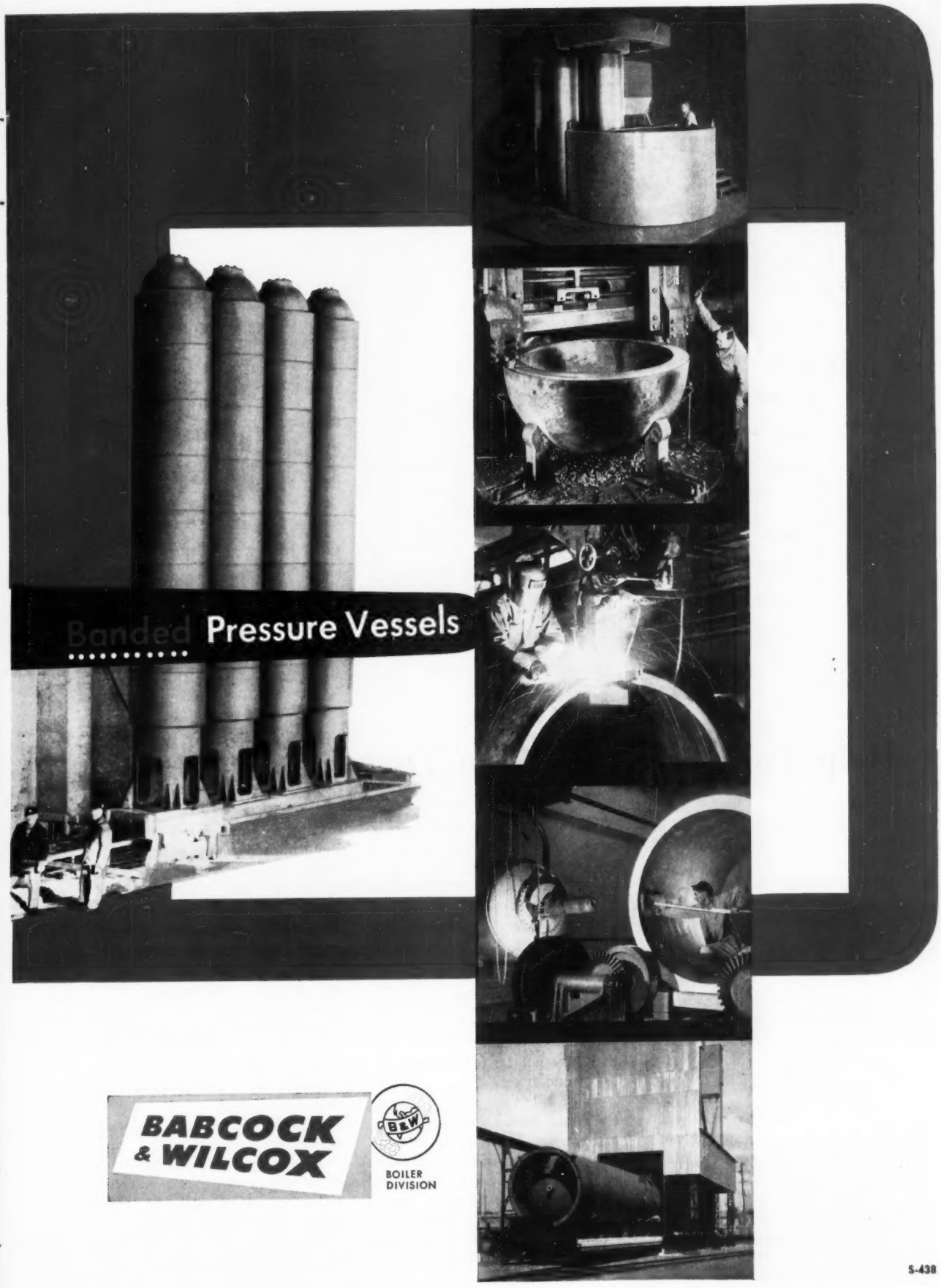
## *Advanced Manufacturing Techniques* Assure Outstanding Service with B&W

Every step in the manufacture of B&W banded pressure vessels is a specialized operation derived from long experience in meeting extraordinary needs.

The inner shell is fabricated to withstand longitudinal pressure loading in accordance with ASME Code requirements. Circumferential reinforcing bands around this inner shell enable it to withstand circumferential pressure loading while affording maximum protection.

Much of the equipment used in each manufacturing step was specially designed and developed by B&W, whose forming, machining, welding, stress relieving and inspection are much more specialized techniques than their names indicate.

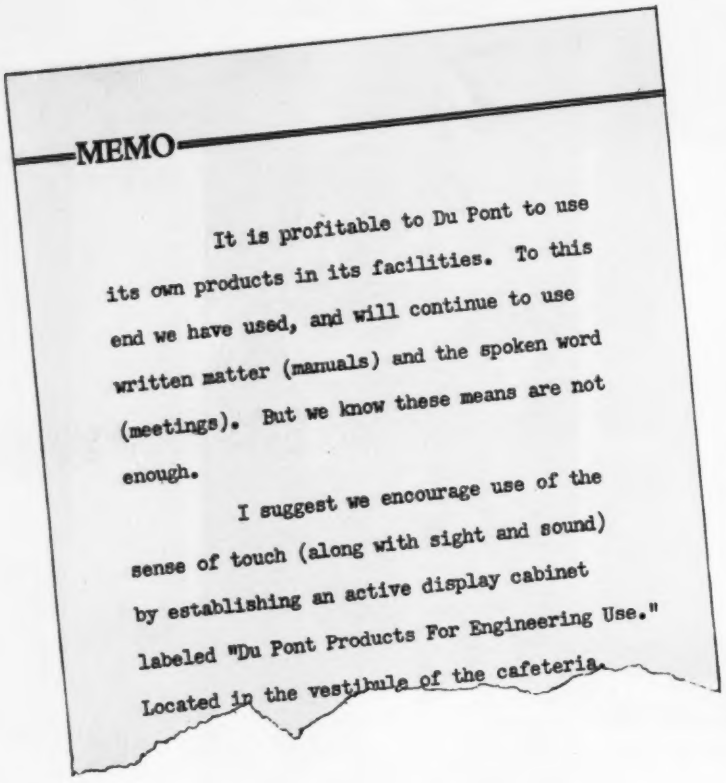
The result? Pressure vessels designed for 2000 to over 6000 psi, with capacities from 50 to 10,000 gallons, and the ultimate in safe and sound process equipment with greater "all-around" advantages than vessels of conventional welded construction. Whatever your pressure vessel requirements, you will do well to consult The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.




BABCOCK & WILCOX

BOILER DIVISION

S-438


MEMO

It is profitable to Du Pont to use its own products in its facilities. To this end we have used, and will continue to use written matter (manuals) and the spoken word (meetings). But we know these means are not enough.

I suggest we encourage use of the sense of touch (along with sight and sound) by establishing an active display cabinet labeled "Du Pont Products For Engineering Use." Located in the vestibule of the cafeteria.

**This memo kicked off a program to help keep engineers up on company products.**

**It's a memo for you, too, a reminder to . . .**

# Help Your Engineers Use Your Products

A chemical company may be one of its own best markets for company products. It may need, for example, in its facilities the very engineering materials it numbers among its own products, or among those which can be made from the products.

Quite obviously, then, the company should try to use as much of its own output as is feasible in its operations. No sense at all in using your competitors' products if you've got one that's as good or better in the family.

But this does happen sometimes. It happens because keeping in close touch with company products, with what they can do, with what they can be made into, is not a simple task for any engineer specifying engineering materials for company construction.

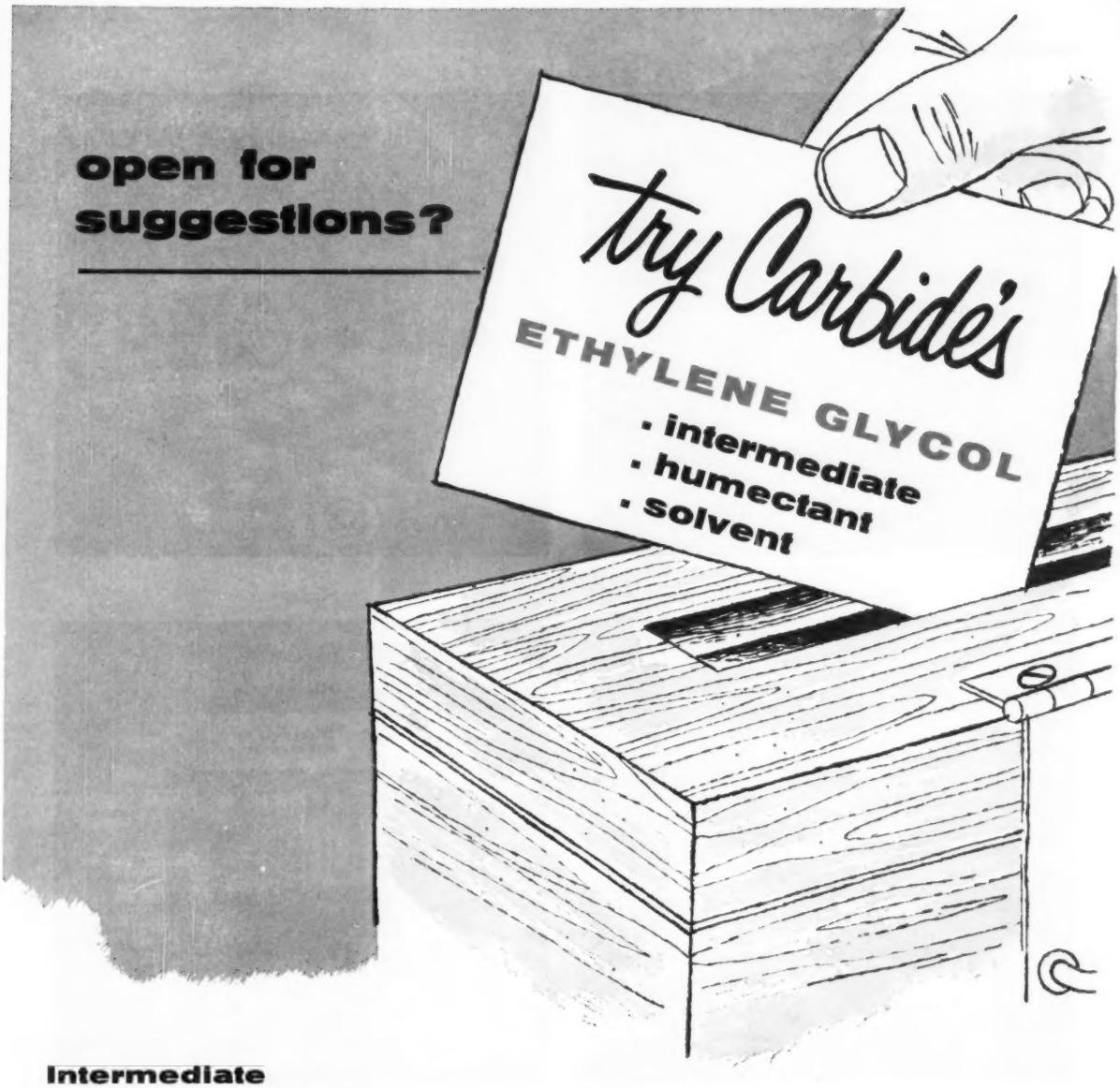
It's a pretty awesome task if you're an engineer working for a company like Du Pont which turns out some 1,200 product lines, most of which are built by others into who-knows-how-many finished products. You can attend all the meetings and read all the company literature and still not be aware enough of all the subtleties of your products to cash in on their potential—a potential, mind you, that may not be fully recognized by anyone as yet.

With all this well in mind, Du Pont initiated this year its newest program for internal product education—a series of technically-slanted displays called "Du Pont Products for Engineering Use." Each display will spotlight a different product. Each, in turn, will bring the viewer up to date.

▶ **Captive Audience**—For maximum impact Du Pont chose a site where the displays could be seen by more than 1,500 technical people who either specify or influence the specification of engineering materials—the cafeteria of the big, H-shaped Louviers building outside Wilmington, Del., which houses the firm's engineering department. Most of Louviers' personnel and visitors eat in the cafeteria, thus present that most cherished of all audiences, a captive one.

Consider that these technical people figure in the design, procurement and construction of $100 million worth of new facilities for Du Pont each year. They possess a real buying power.

There's a lot to be said, then, for gathering products based




## Intermediate

Alkyd Resins for Surface Coatings . . . Ethylene glycol is used in combination with pentaerythritol to produce alkyd resins used in making paints, enamels, and other alkyd based surface coatings.

Polyester Resins . . . Low pressure laminates used on glass fibers, asbestos, cloth, and paper, make use of polyester resins based on maleic anhydride, ethylene glycol, and vinyl type monomers.

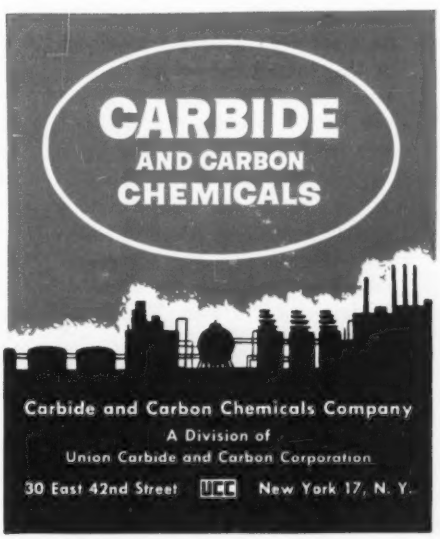
## Humectant

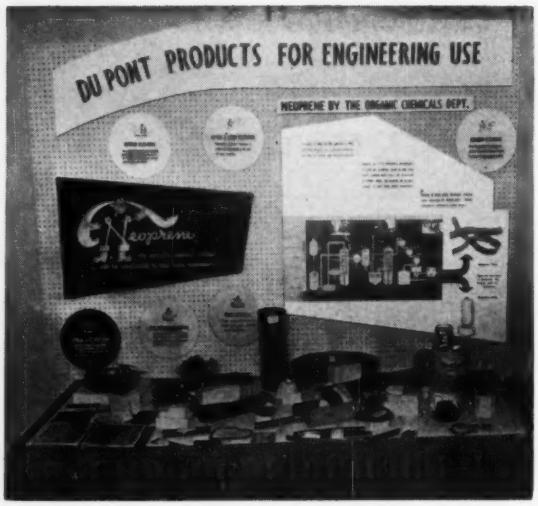
Ethylene glycol adds strength, softness, and pliability to cellophane, paper, glue, leather, and textile fibers.

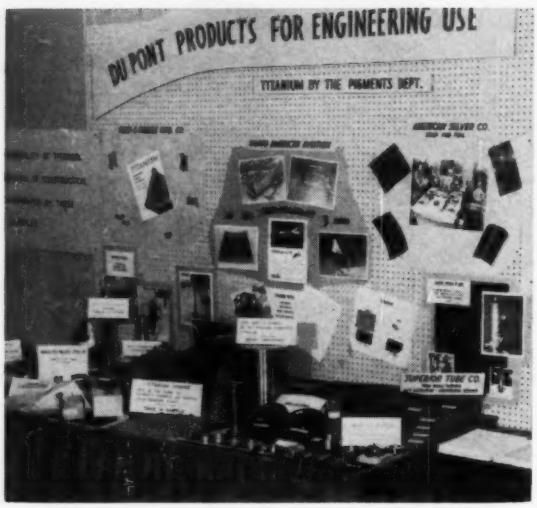
## Solvent

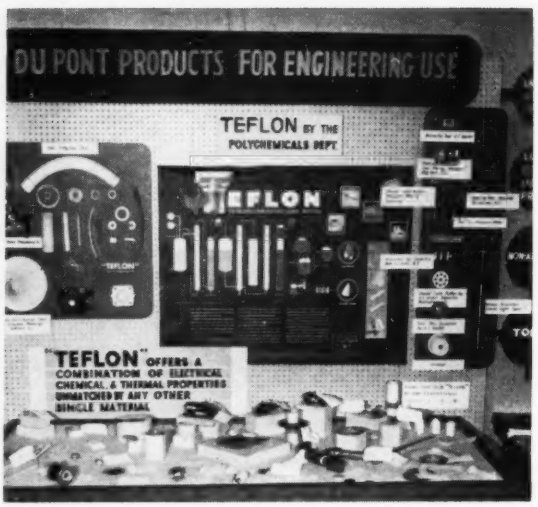
Ethylene glycol is used as a solvent for certain stains, inks, and dyes. It is also a solvent and conducting medium in dry type capacitors.

For more information ask for Technical Information Sheet F-8327 on Ethylene Glycol. Call or write any of 23 sales offices in principal cities. In Canada: Carbide Chemicals Sales Company, Division of Union Carbide Canada Limited, Toronto.







DU PONT PRODUCTS FOR ENGINEERING USE
TEFLON BY THE POLYCHEMICALS DEPT.
TEFLON
"TEFLON" OFFERS A COMBINATION OF ELECTRICAL CHEMICAL & THERMAL PROPERTIES UNMATCHED BY ANY OTHER SINGLE MATERIAL

on company engineering materials so that these same people can not only read and hear about them but can handle, squeeze, stretch, bend and twist them if they've a mind to. For who can say that this contact is not just the catalyst needed to turn something heard or read—but perhaps only dimly recognized before—into a productive idea.

▶ **More Than Public Relations**—Don't confuse this program with the familiar exhibits that make the rounds in a company and are designed to give the employee some idea of his place in the over-all picture of company operations. It differs both in intent and the means; it is geared to convey engineering information to engineers to produce very tangible profits.

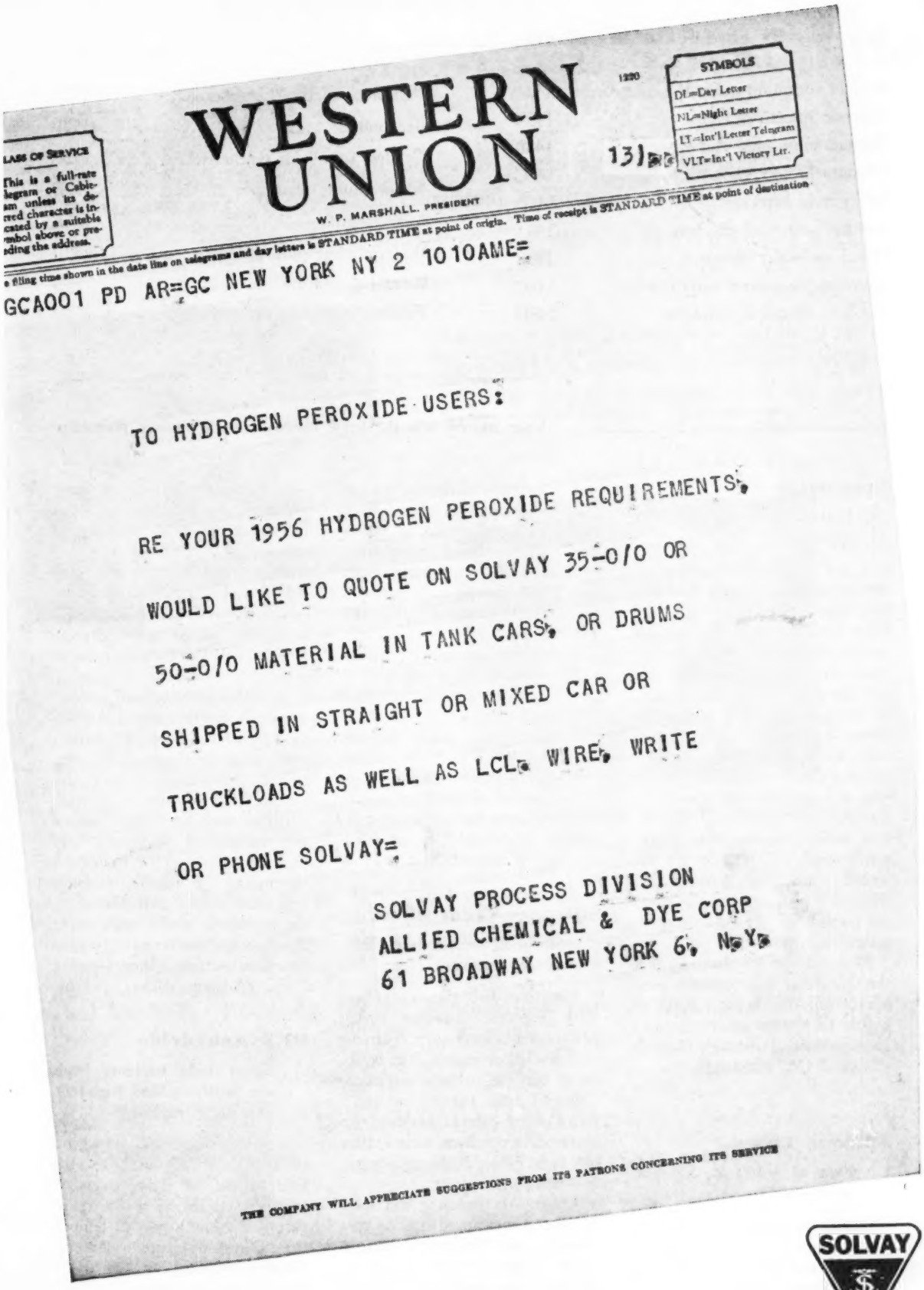
▶ **Cycle and Scope**—Each episode in the Du Pont program runs about seven to eight working days, is succeeded after a four-week interval by another and different display. Each devotes itself to a single material or shows off the products of an entire department. Each is attractive yet not too long on "show." "We want the technical information to sell itself," says Ray Genereaux, special technical assistant to the engineering department management, who conceived the program.

There have been eight displays so far in the program's first year. Response has been good, with an average of 1,800 people showing more than passing interest in each of the exhibits. And not only Louviers engineers see them. Visiting engineers from Du Pont plants, and representatives of the firms that manufacture items from Du Pont products, all get a look.

▶ **Pay-Off Pattern**—That's the pattern—periodic shows, a fresh theme each time, a big and influential audience—another way to reach people. It can't help but pay off.

**142A**

(*Continued on p.* 146)



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## Newsworthy chemicals this month


Product education inside the company....142A
Systemic insecticide .....146A
Silicone lubricants .....146B
Silicones protect glass .....146C
Epoxy resin hardener .....146D
Another source of selenium.....148A
Felted polyester fabric .....148B
Alumium-pigmented vinyl coating.....148C
$Al_2O_3$ is electrical insulator.....148D
"Synthetic natural" rubber.....152A
Benzonitrile .....152B
Catalyst for alkyds synthesis.....152C
Nitrocellulose plasticizer .....152D
Antihistamine .....152E
Waterproofing pulp products.....152F
Bleaching additive .....152G
Tinless, organic solder.....152H


Page number is also Reader Service code number

**For more about any item, use Reader Service**

### Insecticide

**First systemic to win FDA approval.**

A new trend in pesticides seems certain to gain strength from the first approval by the Food and Drug Administration of a systemic insecticide, the kind that moves from one part of a plant throughout the plant and renders it toxic to hungry pests. The insecticide, Systox by name, should prove a boon to truck gardeners, orchardists and other commercial growers who will get the first chance to buy it.

A trialkyl triophosphate, Systox won't wash off because it's absorbed into the plant itself whether it be sprayed on the leaves or poured in a weak solution around the roots.

FDA officials are insisting that the quantities and methods used permit only the faintest traces of Systox to remain in any finished food product.–**Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.** 146A

### Silicone Lubes

**Flow at −100 F., function up to 400 F.**

Silicone compounds are available which lubricate as well as petroleum oils and greases yet retain all typical silicone properties.

Versilube F-50 (a lube fluid) and Versilube G-300 (a grease) possess potential in sleeve bearings, ball bearing motors, instruments, pipe thread compounds, hydraulic systems, refrigerators, etc. They operate even at such temperature extremes as −100 and 400 F.

General Electric says F-50 is effective without use of additives:

- Lubricity without "oiliness" additives
- Low pour point without depressants
- Excellent temperature viscosity properties without improvers
- Inherent stability without oxidation inhibitors.–**General Electric Co., Waterford, N. Y.** 146B

### Silicones Treat Glass

**Shield surfaces, reduce breakage of containers.**

Everytime two glass containers clink together, however softly, neither comes away quite as strong as it was before impact. The weakening may be virtually imperceptible each time, but can become a factor when compounded by the hundreds of occasions when bottles hit each other during packaging and handling.

A bottle in handling will soon develop a cobweb pattern of tiny abrasions and fractures, a pattern which makes it more prone to breakage than when new. Another bottle's history may be identical with one exception: before being put in use it was coated with a surface-shielding film of silicones. It will have much fewer scars and scratches, will have, in effect, retained more of its original strength. In other words, the breakage level is higher because fewer damage points exist for stress concentration.

A further advantage of silicone treatment: the lubricity of the film converts all but 90-degree impacts into glancing blows. Silicone-treated containers, it's claimed, also provide better vacuum or pressure retention with easier cap removal and exceptional drain-back and pour-out properties (if coated on the inside) for aqueous products and rinse water. Self-lubricating, the containers lend themselves to smoother and quieter line operation and less jamming.–**Dow Corning Corp., Midland, Mich.** 146C

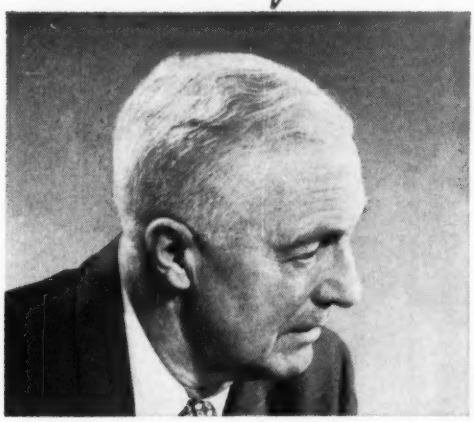
### HET Anhydride

**Epoxy resin hardener lends fire resistance and high-temperature strength.**

A new hardener or curing agent, HET Anhydride, opens up the field further for epoxy resins. A unique combination of fire resistance and strength at high temperatures (heat distortion values approach 392 F.) makes HET Anhydride-cured epoxy castings, printed circuits, laminates, and

# Question for users of Ammonium Sulfate

*Why is B&A Purified Ammonium Sulfate preferred by process men who can't afford to gamble with product purity?*



Makers of food, pharmaceutical and other high purity products specify Baker & Adamson Purified Ammonium Sulfate because they know it is made from carefully selected raw materials . . . and manufactured by B&A to standards as rigid as those of the products in which it is used.

Compare our typical analysis with the Ammonium Sulfate you are now using. You'll find extra "B&A Quality" worth much more than the slight difference in cost over ordinary by-product Ammonium Sulfate. B&A Purified Ammonium Sulfate is available in commercial quantities from B&A stockpoints in major industrial areas across the country.

Remember—to make the best, start with the best. Specify B&A Purified Ammonium Sulfate.

*Because B&A Ammonium Sulfate is not a by-product; it is manufactured to strict specifications from high quality Sulfuric Acid and Ammonia.*

**B&A AMMONIUM SULFATE, PURIFIED**

***Typical Analysis:***

| | | |
|---|---|---|
| Assay ($(NH_4)_2SO_4$) | 99.5 | % |
| Insoluble | 0.005 | % |
| Residue after Ignition | 0.01 | % |
| Chloride (Cl) | 0.001 | % |
| Phosphate ($PO_4$) | 0.001 | % |
| Arsenic (As) | less than 0.00005 | % |
| Heavy Metals (as Pb) | 0.0002 | % |
| Iron (Fe) | 0.001 | % |

REAGENTS B&A STANDARD OF PURITY FINE CHEMICALS

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

*Complete stocks carried here

dies for metal and plastic forming usable under more severe conditions than before. Added benefits: the anhydride works in a 50-50 mixture with epoxy resins, an unusually high ratio. What with expoxies more expensive than HET Anhydride, priced at 55¢/lb., the combined raw material cost is usually lower than for other epoxy-hardener combinations.—**Hooker Electrochemical Co., Niagara Falls, N. Y.** **146D**

## More Selenium

**First commercial-grade deposits discovered.**

This country no longer need rely solely, for its selenium metal, on the anode mud or slime produced in blister copper refining. Deposits recently unearthed in Wyoming—assaying as high as 0.58% selenium—will see to that, although present demand will keep selenium in short supply until at least 1958.

Today, small selenium rectifiers often replace bulky transformers and rectifier tubes in voltage multiplier circuits for radio and television sets. In the glass industry Selenium functions as a decolorizer; in the stainless steel industry, as an additive which improves machineability and controls quality of castings.

Chemical uses, however—such as pigments and rubber accelerators—consume more selenium than both glass and steel combined.—**Shawano Development Corp., New York 22, N. Y.** **148A**

## Coating System

**Aluminum-pigmented vinyl paint system is tops in test.**

Way back in 1949, Vinsynite-Vinyl system and 24 other systems of protective coatings were applied to sections of the steel flood gate of an Ohio River dam. After five years of submersion in river water the Vinsynite-Vinyl system was judged to have shown the best corrosion resistance by 17 observers from industry and the Army Corps of Engineers.

This winning coating consisted of a layer of improved wash-primer (FS-2 Vinsynite) followed by three coats of aluminum-pigmented vinyl paint. Total thickness: 6 mils.

Fourteen phenolic varnish- pigment paints, three rubber base and coal tar coatings and seven other vinyl systems made up the competition.—**Thompson and Co., Oakmont, Pa.** **148C**

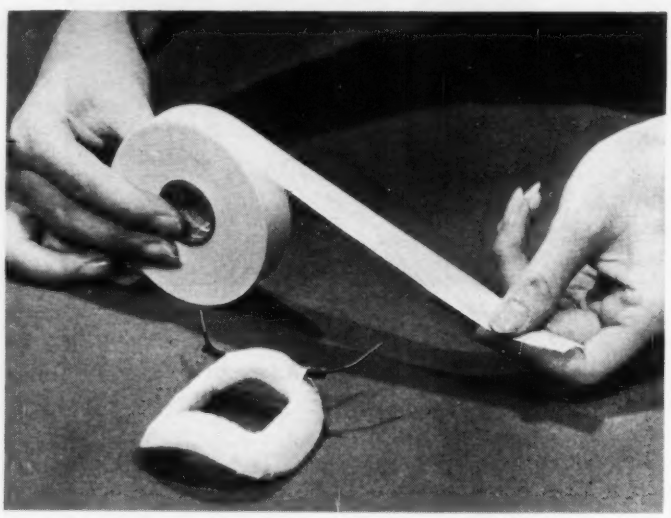
## $Al_2O_3$ for Insulation

**A 0.0002-in. oxide film provides enough insulation for aluminum coils.**

Winding coils with aluminum foil or sheet insulated only by an anodized layer of aluminum oxide is feasible now. This could presage extensive replacement of copper in transformers, solenoids or electric magnets, maybe even in some motors and generators.

Copper's use in transformers alone runs about 200 million lb. a year. Reynolds says only 100

(*Continued on p. 152*)



## Polyester Fabric—Nonwoven and Felted

**Making a bid for use by makers of varnish or resin impregnated coils, as well as by electrical motor repair and rebuilding shops is Scotch brand polyester web. Unique in form—it's nonwoven and felted—this fabric is said to offer increased moisture resistance, superior varnish pickup ability and greater conformability than conventional cotton, glass or synthetic cloths.**

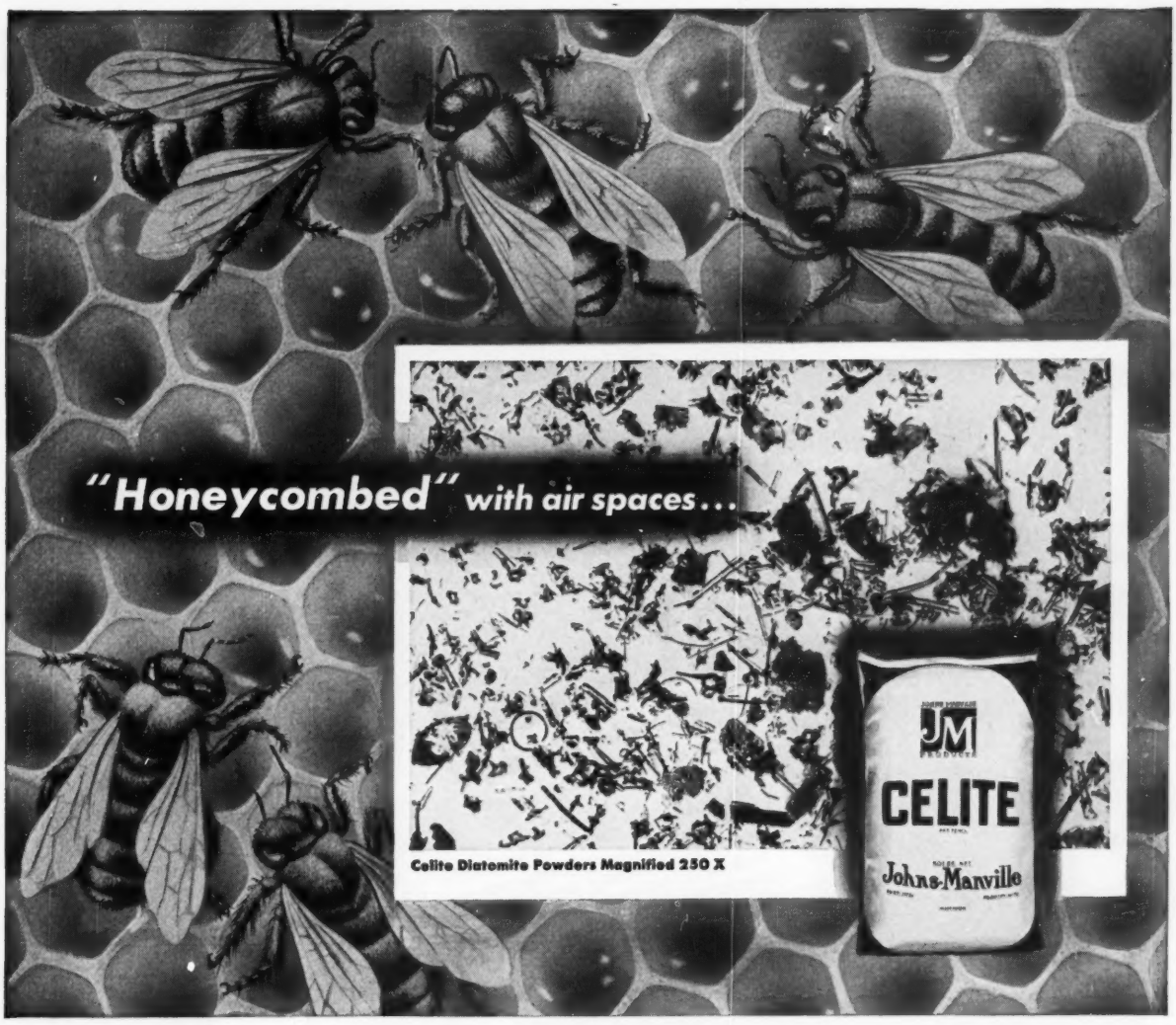
**• Varnish pickup: 2½ times that of cotton cloth. Elimination of extra dipping and baking cycles will reduce production costs for impregnating electrical components.**

**• Moisture absorption: only 0.5% as compared to 24-27% for cotton cloth. This cuts out extra bake cycle required to dry cotton cloth before impregnation.**

**• Felted, nonwoven web construction: a non-ravelling edge highly resistant to tear; a material that conforms snugly to irregular surfaces without pulling apart or slipping.—Minnesota Mining and Mfg. Co., St. Paul 6, Minn.** **148B**

**For More Information . . .**

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.




# Celite Powders provide bulking action

## 3 to 10 times greater than any other inert mineral filler

POUND FOR POUND, Celite* diatomite powders supply more bulking action than any other inert mineral filler because their cubic volume is 3 to 10 times greater. Celite's unique "honeycombed" structure is composed of microscopic, irregularly shaped particles that won't pack down. In mass they weigh only about 10 lbs. per cubic foot.

That's why Celite is so widely used to add bulk and body to industrial formulations. For example, it extends white pigments in paints and papers . . . it improves dispersion of insecticides and fertilizers . . . it fluffs up dry powders such as household cleansers.

Also, from Celite's "honeycombed" structure comes its great absorptive capacity. This characteristic is profitably utilized to keep powders free-flowing . . . to provide a medium for shipping or storing liquids in dry form. And because of the physical structure of its individual particles, Celite has become the outstanding flatting agent for paints . . . it serves as a mild, non-scratching abrasive for fine polishes . . . it improves the surface appearance of plastics.

Which of the many Celite advantages can you use to build product performance or cut costs? A Johns-Manville Celite Engineer will gladly discuss your problem, without obligation. For his services or more information, write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay St., Toronto 1, Ontario.

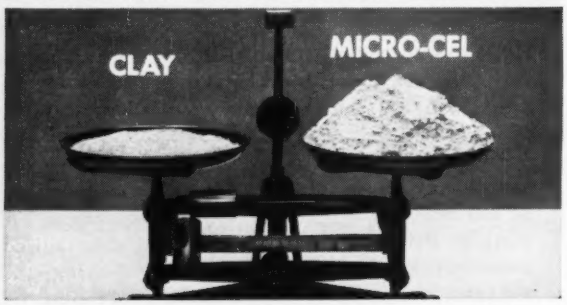
*Celite is Johns-Manville's registered Trade Mark for its diatomaceous silica products.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville CELITE** INDUSTRY'S MOST VERSATILE MINERAL FILLER

# *Announcing*... a new line of synthetic

The powder that flows like a liquid
Micro-Cel (as compared with clay in photo) will greatly improve the flowability of many products . . . maintains its free-flow properties even under the most adverse storage conditions.

**Absorbs up to 6 times its weight in water**—Micro-Cel remains a free-flowing powder even after absorbing more than twice its own weight of liquid.




**High bulk . . . loose weight density as low as 5 lb. per cu. ft.**—Micro-Cel "fluffs up" any compound with a minimum addition.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville MICRO**

# calcium silicates developed by Johns-Manville Research

# MICRO-CEL...

**Check its different combination of properties . . . it may hold the key to lower costs and product improvements in your process formulations.**

Johns-Manville's new Micro-Cel line can produce many desirable effects as the following examples illustrate.

**Absorption of Liquids**—Micro-Cel will absorb 1 to 2½ times its weight of liquids and still remain a free-flowing powder.

**Uniform Dry Dispersion**—Different Micro-Cel grades with particle sizes as low as .02 microns and particles of rounded to spherical shape provide fast, uniform blending without segregation.

**Viscosity Control**—Various degrees of viscosity up to a paste or semi-solid can be achieved by adding relatively small quantities of Micro-Cel.

**Anti-caking Agent**—Micro-Cel's high absorption and fine particle size of less than 0.1 micron effectively control caking of deliquescent products and insure flowability even after prolonged storage.

**Bulking Agent**—A small percentage of Micro-Cel materially increases the bulk of dry powders—allows control of package density.

**Pigment Extender**—Micro-Cel's surface characteristics, fine particle size and large specific surface, combined with inertness, indicate its value as a pigment extender.

**Suspension Agent**—Micro-Cel's different combination of properties provides aid in suspension of heavier solids.

**Flatting Agent**—Micro-Cel's high absorption, fineness and particle shape indicate its value as a flatting agent.

**Reinforcing Pigment**—The combination of fine particle size, particle shape, and wetting characteristics suggests the value of Micro-Cel as a reinforcing pigment.

### Some Proven Uses

Micro-Cel has already been proven as offering outstanding advantages as an absorbent-grinding aid for high liquid concentrate insecticide wettable powders, as an anti-caking agent in fertilizers, insecticide dusts, cleansers and detergents. Additional uses are being explored in Johns-Manville's Research Center.

### Chemical Composition

Developed after years of research and experimentation by Johns-Manville, Micro-Cel is produced by the chemical combination of lime and diatomaceous silica under carefully controlled conditions. As a result, specific grades are available offering a wide range of physical properties.

**RANGE OF PHYSICAL PROPERTIES**

| | |
|---|---|
| Color | white or off-white |
| *Absorption, % by weight | |
| Water | 300-600 |
| Oil | 275-500 |
| Bulk density, lb./cu. ft. | 5-15 |
| Ultimate particle size, micron | .02 to .07 |
| pH | 8.0-10.0 |
| Moisture (free), wt., % | 5-8 |
| Refractive index | 1.52-1.55 |
| Available surface area, sq.m./gm. | 95-175 |

*Will absorb 1 to 2½ times its weight in liquid and remain a free-flowing powder.

### Samples Now Available

Micro-Cel is now available for laboratory and production evaluation. Write to Johns-Manville for further data on your specific problems. An engineer from J-M's Celite division will be glad to work with you in adapting Micro-Cel to your own particular requirements. Mail coupon today.

Johns-Manville, Box 60, New York 16, N. Y. CE-12
In Canada: Port Credit, Ontario

☐ Please send additional data and samples of Micro-Cel. I am interested in formulating the following products:

_____

☐ Please have local representative contact me

Name_____

Position_____

Company_____

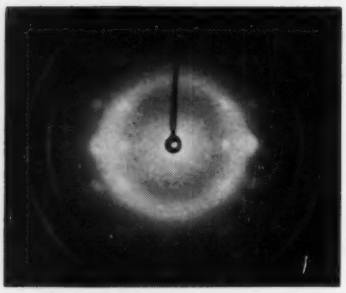
Address_____

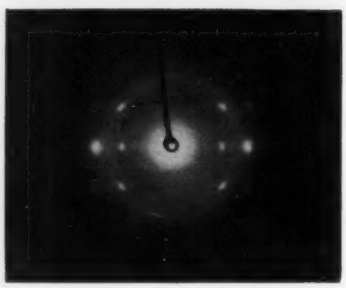
City_____ Zone____ State_____

**-CEL** **SYNTHETIC CALCIUM SILICATE**

**A PRODUCT OF THE CELITE DIVISION**

million lb. of aluminum can do the same job, cites as an example a recently fabricated 10 kva. transformer coil. This coil, which would have called for 41 lb. of copper, was duplicated—in the same space and with the same conductivity of copper—with but 20 lb. of the special aluminum oxide-coated aluminum wire.—**Reynolds Metals Co., Louisville 1, Ky.** **148D**





## Lookalikes

**X-rays show new synthetic rubber has natural product's structure.**

Substantiating Goodrich-Gulf Chemical's claim to a synthesis of crude, or tree, rubber are these recently released X-ray diffraction photographs. Top: a crystal pattern of a tree rubber molecule. Below: Goodrich-Gulf's Ameripol SN.

The "synthetic natural" rubber is giving service comparable to that of tree rubber in large truck tires, the only tires in which synthetic rubbers have not been entirely satisfactory. Of further significance: these heavy duty tires represent one of crude rubber's last strongholds.

Goodrich-Gulf will soon build a pilot plant in Ohio to turn out Ameripol SN. Firestone Tire & Rubber is very active, too, having revealed that a pilot plant is already making it own synthesized tree rubber and that tire tests are in full swing.—**Goodrich-Gulf Chemicals, Inc., Cleveland 3, Ohio.; and Firestone Tire & Rubber Co., New York 1, N. Y.** **152A**

**For More Information . . .**

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

## Briefs

**Benzonitrile** can be produced, say company spokesmen, in commercial volume at prices attractive to many industries: plastics, pharmaceuticals, synthetic coatings, solvents, etc. Key is a new process which is already turning out developmental quantities of benzonitrile for evaluation.—**Tennessee Products & Chemical Corp., Nashville 3, Tenn.** **152B**

**An alkyds catalyst,** lithium ricinoleate, is said to be faster and more reliable than any ester interchange agent now in use. Points claimed: no poisoning by residual phthalic; reduction of alcoholysis time; no formation of colloidal metal phthalates as with lime or litharge catalysts; production of light-colored, precipitate-free monoglycerides.—**Baker Castor Oil Co., New York 5, N. Y.** **152C**

**New nitrocellulose plasticizer,** an octyl butyl phthalate called Plasticizer 84, is superior to dibutyl phthalate (DBP) in permanence, heat sealability and cold check resistance. Permanence: Less plasticizer loss from films on heating to 220 F. for 1, 2, 3 and 5 hr. Heat sealability: Film incorporating Plasticizer 84 sealed at lower temperatures than dibutyl phthalate and tricresyl phosphate film and showed increased blocking resistance.—**Eastman Chemical Products, Inc., New York 17, N. Y.** **152D**

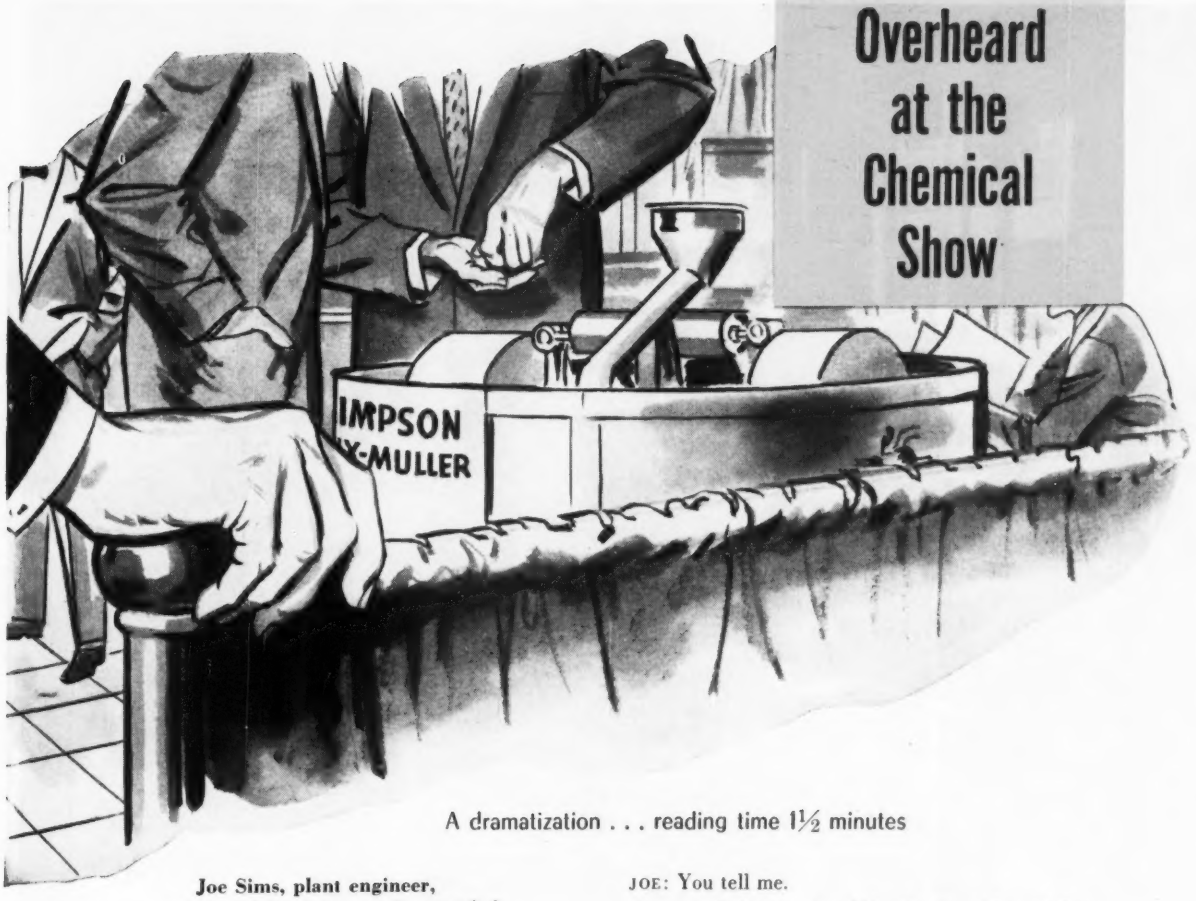
**A antihistamine with few side effects** is Diafen (diphenylpyraline hydrochloride). Size of an effective dose is the smallest on the market—each 2 mg. tablet is the size of a quarter-grain saccharine tablet. Diafen has been effective in a wide variety of allergies and disorders.—**Schenley Laboratories, Inc., New York, N. Y.** **152E**

**Waterproofing pulp products** from wood and straw is possible by reacting metal ions with the natural substances already present in the fibers: lignin, fatty acids, phenolic materials. Usually an outside organic agent is precipitated—via metallic ion addition—onto the surfaces of the fibers to obtain sizing.—**Prairie Regional Laboratory, National Research Council, Saskatoon, Saskatchewan.** **152F**

**Bleaching additive,** X-Tan-Assist, inhibits corrosion and odor formation caused by sodium chlorite. It also increases the latter's bleaching effectiveness by as much as 50% (and reduces consumption by one-third). X-Tan-Assist does all this by slowing chlorine dioxide formation to the rate at which it is consumed in bleaching.—**Tanatex Corp., Kearny, N. J.** **152G**

**Tinless, organic solder** may free the metal container industry from its dependence on imported tin. The new high strength bonding cement adheres well to plain metal as well as to lacquered surfaces, and tests, on the average, 15 lb. stronger than tin-lead solder. Another advantage: use of tinless solders eliminates "solder stripe" on cans, thus permitting all-over enamel labeling.—**Dewey & Almy Chemical Co., Cambridge, Mass.** **152H**

# Overheard at the Chemical Show




A dramatization . . . reading time 1½ minutes

**Joe Sims, plant engineer, wasn't as idly curious as he sounded when I overheard this conversation at a recent trade show:**

JOE: What're you grinding up there?

*Answer:* It's sawdust—but we don't *grind anything* here. We're "mulling" *(pouring the contents of an envelope into the mixer)*. Watch this . . . *(pause)*.

JOE: That was fast!

*Answer:* The Mix-Muller dispersed that green dye throughout the sawdust in less than 2 minutes. Call the dye a binder or a reagent and you can better understand why a smearing or rubbing action is essential where dry materials must be mixed with relatively small quantities of liquids, semi solids or amorphous solids.

JOE: You tell me.

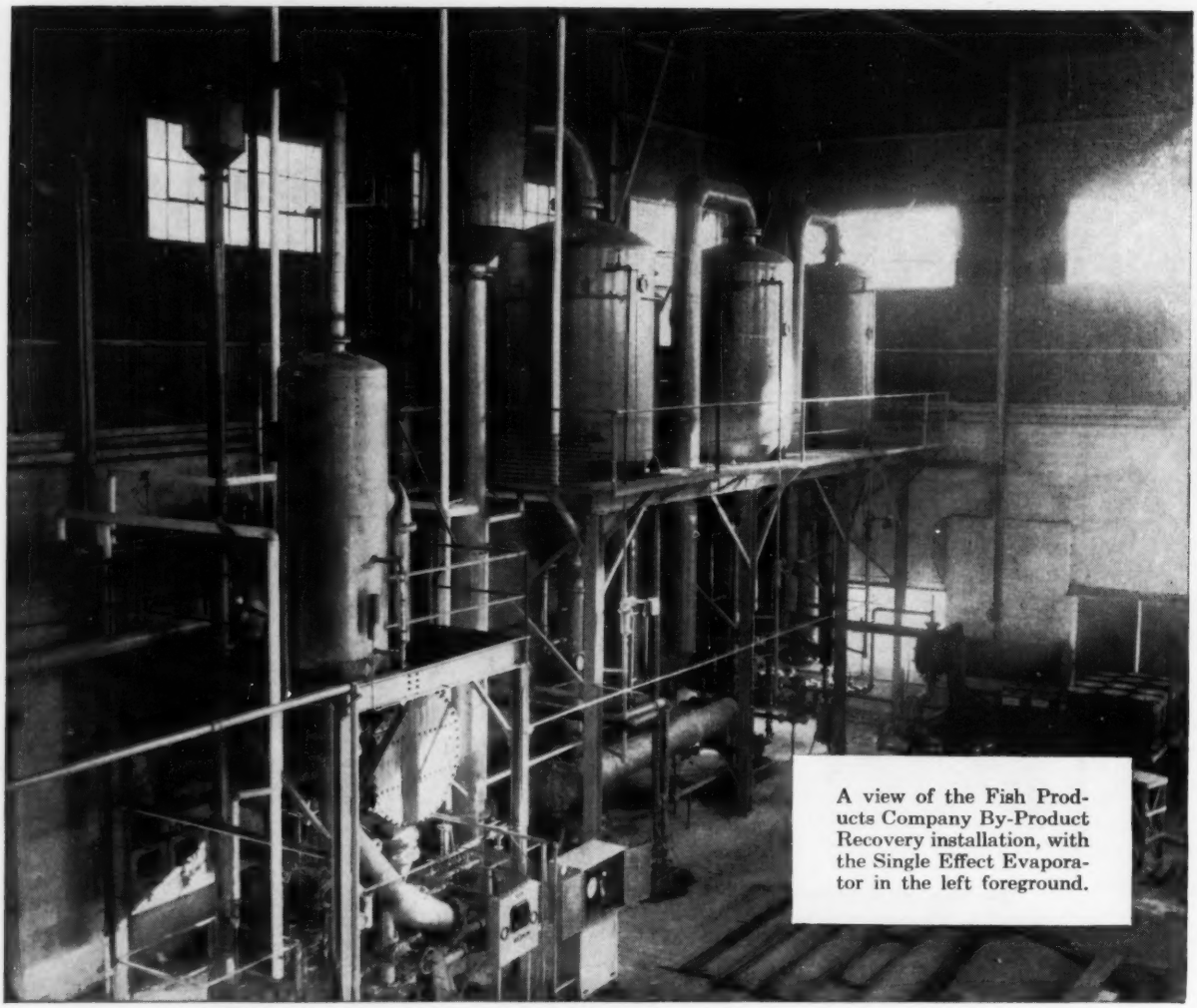
*Answer:* OK, if I *stirred* the dye in with a stick or paddle we would have a pepper and salt effect. The elements would be *next* to each other but not blended. It takes the folding of the Mix-Muller plow action, combined with a rubbing, kneading, muller action to give you an intimate, *reacted* if you will, blend of materials. Apply that to a product that must be extruded, cast, briquetted or wetted to a slurry and you can see why we say we sell *controlled uniformity* here.

JOE: *(Later and aside to me)* You know, asking those Mix-Muller people what mulling is, is like putting a nickle in a juke box. They've got a whale of a story on mixing dry solids—I *know* . . . we've got five of them in our plant. I reconfirm this story every time I come to this show.

**If *you* mix, and it's dry but not a powder, wet but not a liquid there's a whale of a story in this book for you. Write for "Mulling for the Chemical and Process Industry" today!**

**SIMPSON *MIX-MULLER*® DIVISION**

**NATIONAL ENGINEERING CO., 636 Machinery Hall Bldg., Chicago 6, Ill.**
(Not Inc.)



A view of the Fish Products Company By-Product Recovery installation, with the Single Effect Evaporator in the left foreground.

**WITH BUFLOVAK EQUIPMENT ...**

# Fish Products Company recovers vitamins and protein solids from fish oil waste

To recover valuable vitamins and protein solids from fish oil waste liquor, the Fish Products Company, in various of its plants, utilizes several large duplicate installations of Buflovak equipment, which were designed and built by Blaw-Knox Engineers; which included these units:

—3750 sq. ft. average Triple Effect Carbon Steel Evaporator and auxiliaries, which include Liquor Preheaters, Liquor Level Controllers, Barometric Condenser, and so on.

—1430 sq. ft. Single Effect Forced Circulation Sheet Steel Evaporator and auxiliaries. The latter include Vapor and Liquor Separator, Byer Barometric Condenser, BUK Density Indicator and other units.

Blaw-Knox is prepared to help you solve any by-product or industrial waste recovery problem you may have. Feel free to call on us.

Catalog No. 351 on By-Product Recovery is available on request.

## A Complete Process Equipment Service

By-product recovery is but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries:

EVAPORATION • DRYING • FLAKING • MIXING • IMPREGNATING • REACTION • SOLVENT RECOVERY • SOLVENT EXTRACTION • GAS CLEANERS • GAS ABSORPTION • VULCANIZING • STERILIZING • CRYSTALLIZATION • DISTILLATION • HEAT TRANSFER • POLYMERIZATION • VAPORIZATION • CONDENSATION • LOW and HIGH PRESSURE PROCESSING

*Everything in Process Equipment*

**BLAW-KNOX COMPANY**
**BUFLOVAK EQUIPMENT DIVISION**
1551 Fillmore Avenue, Buffalo 11, N. Y.

# THE RIGHT STEAM TRAP FOR LIGHT CONDENSATE LOADS

## YARWAY 20-A IMPULSE STEAM TRAP

● Successful companion to the standard Series 60 YARWAY Impulse Steam Trap, the ½" No. 20-A is right and recommended for *light load* applications in:

**REFINERIES, CHEMICAL AND PROCESSING PLANTS** on steam tracer lines, meter boxes, steam mains, separators, small dryers, pipe coils, small unit heaters, etc.

**POWER PLANTS** on headers, fuel oil preheaters, compressed air lines, small steam jacketed fire pumps, etc.

**HOSPITALS, SCHOOLS, HOTELS AND INSTITUTIONS** on autoclaves, sterilizers, steam tables, washers, small pressure cookers, steam mains, etc.

**LAUNDRIES** on small presses, puff irons, sock forms, drying cabinets, starch cookers, steam mains, etc.

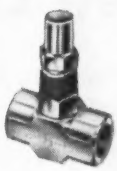
The 20-A has all the YARWAY Impulse Trap features such as small size, stainless steel body and working parts, low cost, non-freezing—and immediate availability through 270 local Industrial Distributors.

Write for Bulletin T-1739-X.

**YARNALL-WARING COMPANY**
137 Mermaid Avenue, Philadelphia 18, Pa.

**There's a Yarway Impulse Trap for every trapping need**

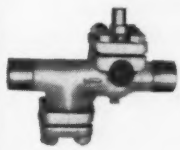
**SERIES 60 AND 120**
For all *normal* trap requirements, pressures to 400 and 600 psi.



**½" No. 20-A**
For *light loads* on tracer lines, steam mains, small presses, etc.

**SERIES 40**
For *heavy loads* requiring extra high capacity steam traps.

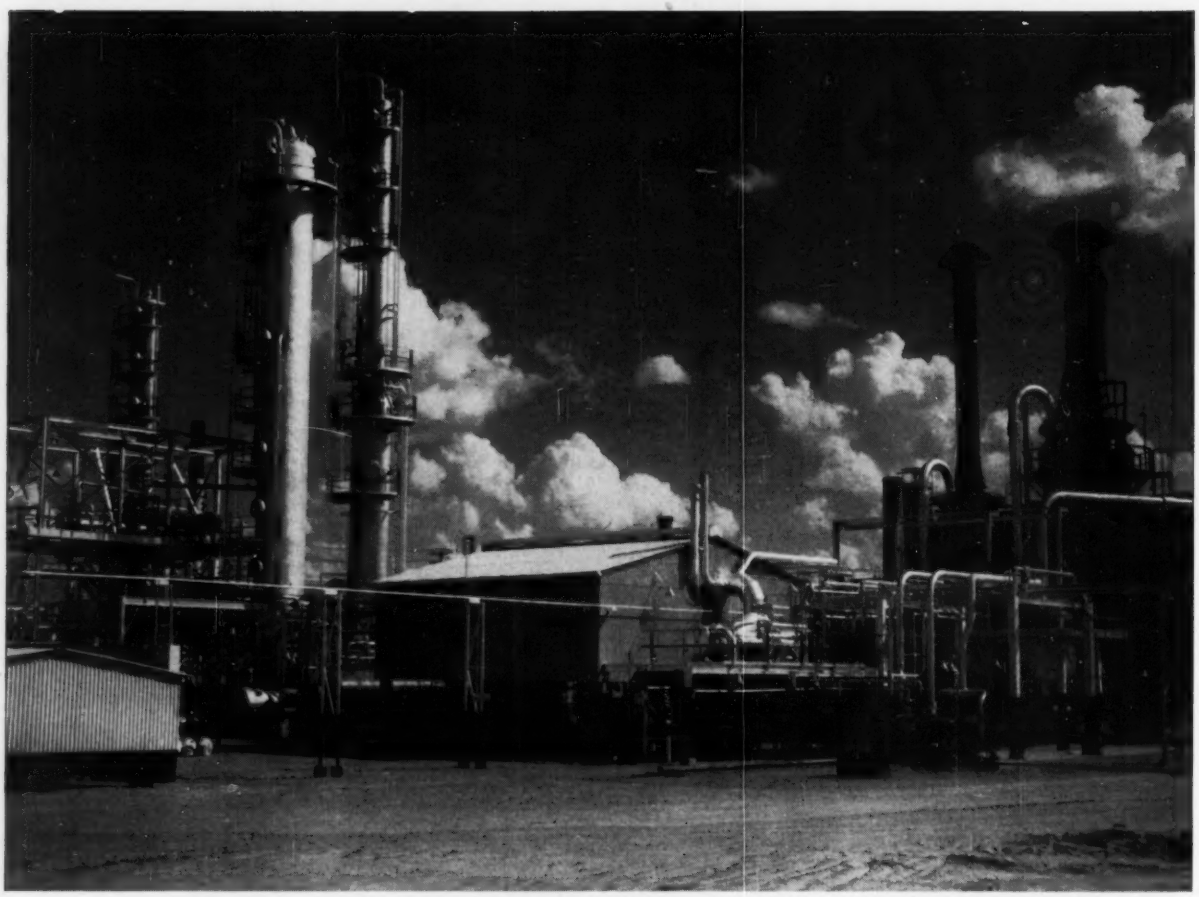
**INTEGRAL-STRAINER HIGH PRESSURE TRAP**



For *high pressures, high temperatures.* (Flanged or welding connections.)

YARWAY® **IMPULSE STEAM TRAP**

*OVER 1,000,000 YARWAY IMPULSE STEAM TRAPS USED*



Catalytic reforming plant designed and engineered by The M. W. Kellogg Company

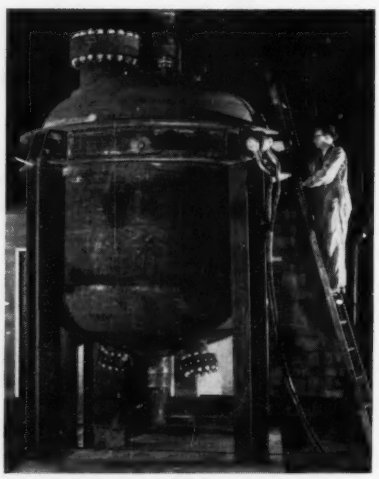
# New Catformer Boosts D-X Octane

This is the ultra-modern, 7,500-BPSD catalytic reforming plant of Mid-Continent Petroleum Corporation, producer of D-X and D-X Ethyl Lubricating Gasolines. First large unit of its type to be completed in the Southwest, the plant has many advantages over conventional thermal refining. The platinum-catalyst process boosts octane numbers in straight-run gasoline, produces a high yield of aromatics, and reduces the loss of charging stock.

At the very heart of the unit are three 22-ton catalytic reforming reactors fabricated by Bethlehem (one of which is shown at right). Because of the rugged service conditions—pressures to 726 psi and temperatures to 975 F—extreme care was required in welding the 2 9/16-in.-thick shells, flanges and fittings. The welds were radiographed and the vessels were hydrostatically tested after assembly in the Bethlehem Weldment Shop.

What's more, each vessel was fitted inside with stainless-steel shroud sections, spider arms, and 352 insulator studs. It all added up to a tricky fabricating job.

Let us know next time you're in the market for welded construction. Our shops in Bethlehem, Pa., and Beaumont, Tex., have long experience in the custom production of chemical and petroleum processing equipment.

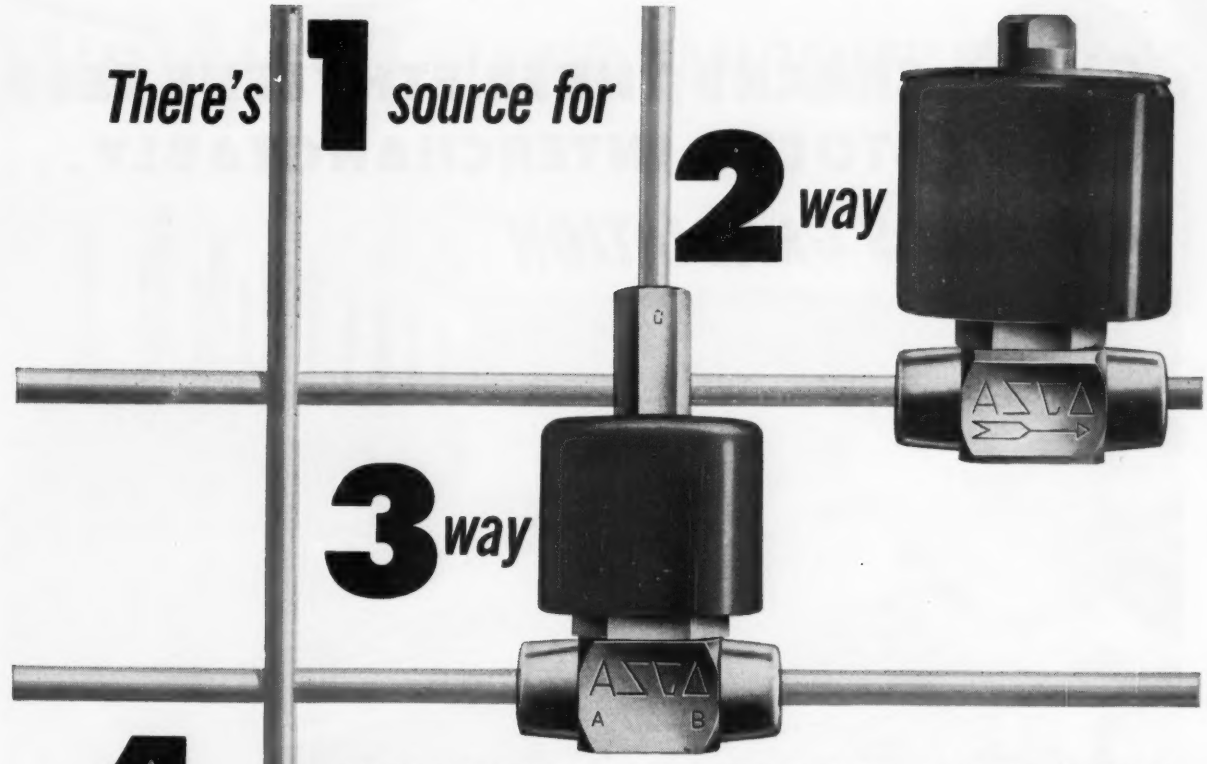


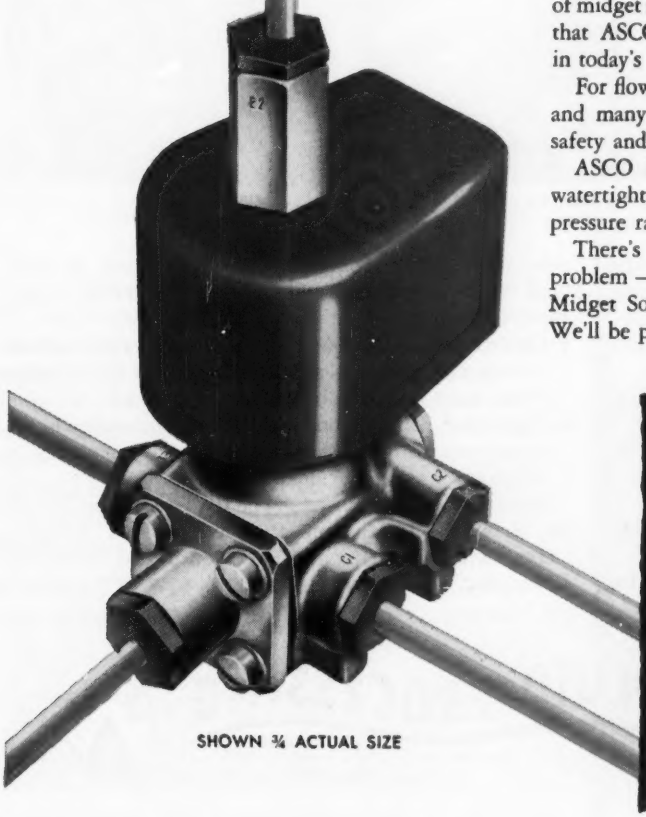
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation.
*Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

# There's 1 source for 2 way 3 way or 4 way MIDGET SOLENOID VALVES



SHOWN ¾ ACTUAL SIZE

Progressive designers, the men who lead the trend toward miniaturization, depend on ASCO as the one source for a full line of midget solenoid valves. The unexcelled quality and dependability that ASCO pioneered in the solenoid valve field is found, too, in today's midget solenoid valves. Only the size has been reduced.

For flow applications using air, gas, water, light oil, refrigerants and many other liquids, ASCO Midget Valves assure complete safety and truly exceptional performance.

ASCO Midget Solenoid Valves are available with standard, watertight or explosion-proof enclosures. Pipe sizes ⅛" and ¼"; pressure range 0-1000 psi.

There's *one* source that solves virtually any solenoid valve problem – ASCO. Write today for complete data on ASCO Midget Solenoid Valves – or outline any of your requirements. We'll be pleased to assist you.

ASCO®

Automatic Transfer Switches
Electromagnetic Controls
Solenoid Valves

Automatic Switch Co.

381 Lakeside Avenue ● Orange, New Jersey

# GULF CRACKS THREE ETHYLENE FEED STOCKS INTERCHANGEABLY...

## with SELAS GRADIATION®

Gulf Oil Corporation's new ethylene plant at Port Arthur, Tex., designed and constructed by Stone & Webster Engineering Corporation. Eight Selas Gradiation heaters are in center foreground.

The world's largest ethylene-producing plant benefits from the versatility of Selas Gradiation heaters. Three separate feed stocks—propane, ethane and propane-propylene mixtures—have been processed interchangeably in all of the eight Selas furnaces.

Operating results on all three feed stocks in the Gulf plant confirm that these Selas heaters provide:

- "On stream" periods, without shutdowns, well in excess of 30 days.
- High conversions and selectivity.
- Optimum conditions, even with extreme variations in feed stock.

Zone control of heat input, enabling Selas heaters to meet any time-temperature curve in pyrolytic or catalytic reactions and high-temperature preheating, is featured by:

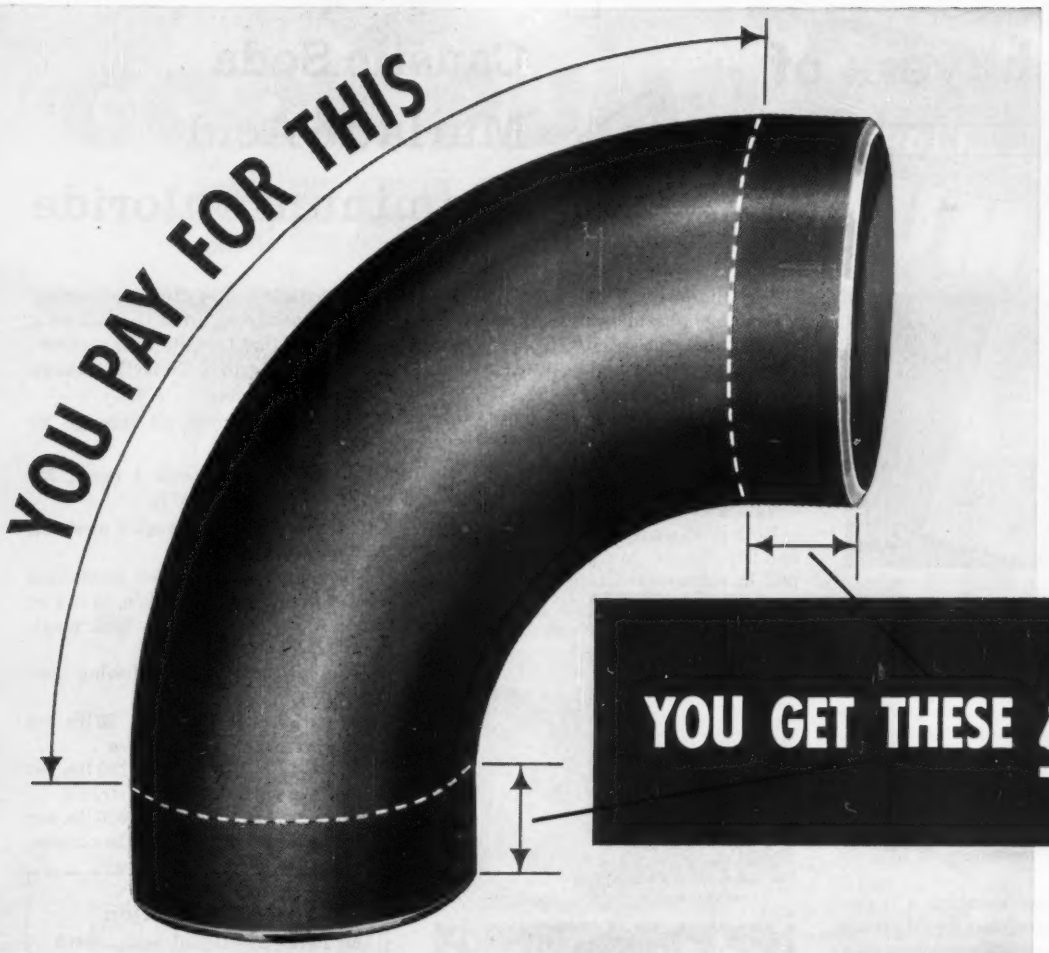
- Uniform heat distribution on the entire tube surface —eliminating local overheating, material degradation at the tube wall and, hence, longer tube life.
- Controlled combustion, with little or no excess air to cause external oxidation of the tubes . . . no lag in response to controller demand.

Send for copy of reprint, "Try the Gradiation Heater for Economical Ethylene Production" and Bulletin, "Gradiation Heating for Petroleum and Chemical Processing."

**SELAS**
**CORPORATION OF AMERICA**
**PHILADELPHIA 34, PENNSYLVANIA**

**FLUID PROCESSING**

# MIDWEST "LONG TANGENT" ELBOWS




**In no other welding elbow do you get this "bonus" of long tangents. The dotted lines show where standard elbows end. Each shaded straight end equals ¼ of the nominal fitting diameter . . . a 12" Midwest "Long Tangent" Elbow has tangents 3" long. As a result of the advantages listed at the right, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows . . . which cost no more than other elbows. For further information, write for Catalog 54.**

**MIDWEST PIPING COMPANY, INC.**
Main Office: 1450 South Second Street, St. Louis 4, Mo.
*Plants: St. Louis, Passaic and Los Angeles*

***Sales Offices:***
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Boston 27—426 First St. • Los Angeles 33—520 Anderson St.
Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg.
Cleveland 14—616 St. Clair Ave. • Miami 34—2103 Le Jeune Rd.
***STOCKING DISTRIBUTORS IN PRINCIPAL CITIES***

## ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS

**MIDWEST HAS THE MOST COMPLETE LINE**

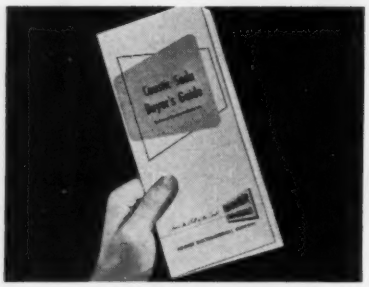
7325

MIDWEST **WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS**

# BRIEFS

## for buyers of

# Caustic Soda
# Muriatic Acid
# Aluminum Chloride




### What strength caustic should you buy?

This new booklet gives facts every buyer should know about caustic soda.

It contains a handy nomograph to help figure for yourself whether 50% or 73% caustic is your better buy.

Contents include a list of reasons *pro* and *con* switching to 73% caustic if you are now using 50%. There's a factual discussion of the economics of 73% vs. 50%.

The booklet also contains a nomograph for estimating your liquid caustic requirements for various process solution strengths; a table showing dimensions and capacities of the different containers in which Hooker caustic soda is shipped; and a list of points to look for when you're choosing a caustic soda supplier.

Check the coupon at right for your copy (or write us if you'd like more than one).

### High-purity HCl.

Probably the purest muriatic acid you can buy in volume anywhere is Hooker White.

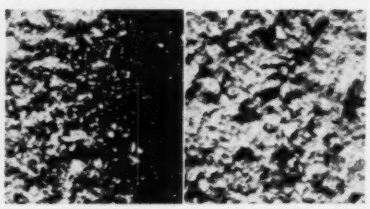
This special-grade muriatic is entirely free of arsenic. It contains .003% or less sulfates, and .0001% or less iron.

Leading pharmaceutical firms are among those who specify Hooker White when they want a highly pure starting material.

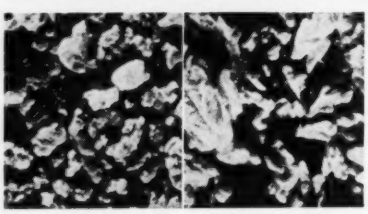
If your requirements are slightly less stiff, we recommend Hooker commercial grade muriatic. This grade is entirely arsenic-free, and has very low sulfate and iron content.

Both grades are available in 18°, 20°, and 22° Baumé. Muriatic acid is shipped in rubber-lined tank cars and 13-gal. glass carboys.

For technical data sheets, check the coupon.



EXTRA FINE GRIND FINE GRIND



COARSE GRIND COARSE SCREENED

### Catalyst control.

Surface area of a solid catalyst, such as aluminum chloride, of course bears an important relationship to reaction rate.

That's why we make aluminum chloride in four different mesh sizes (shown above, actual size). You can get close control of reaction and feeding rates by specifying, from the following list, the size that best fits your process:

1. Extra fine grind (90-95% through 40 mesh).
2. Fine grind (almost all through 20 mesh).
3. Coarse grind (through 1 mesh, 25-35% through 20 mesh).
4. Coarse screened (through 1 mesh, on 20 mesh).

This material is a grayish crystalline solid containing 98.5% $AlCl_3$ in coarse sizes, 97.5% in fine sizes, with maximum iron content of 0.05%.

It is shipped in the following containers:

5-gal. pails ..... 50 lbs. net
10-gal. removable head drums ..... 100 lbs. net
55-gal. removable head steel drums ... 550 lbs. net

For technical data, check the coupon.

**For more information** on items mentioned here, check below.

- ☐ Aluminum Chloride, anhydrous
- ☐ Caustic Soda, liquid (50% and 73%)
- ☐ Muriatic Acid

**Do you process** with any of these compounds? The list below is only partly representative of high-quality materials available in quantity at Hooker. Check those on which you'd like more information.

- ☐ Antimony Trichloride, anhydrous
- ☐ Benzotrichloride
- ☐ Benzoyl Chloride
- ☐ Benzyl Chloride
- ☐ Benzyl Thiocyanate
- ☐ Butyryl Chloride
- ☐ Caprylyl Chloride

*Clip and mail* to us with your name, title, company address.

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*From the Salt of the Earth—1955*

**HOOKER ELECTROCHEMICAL COMPANY**

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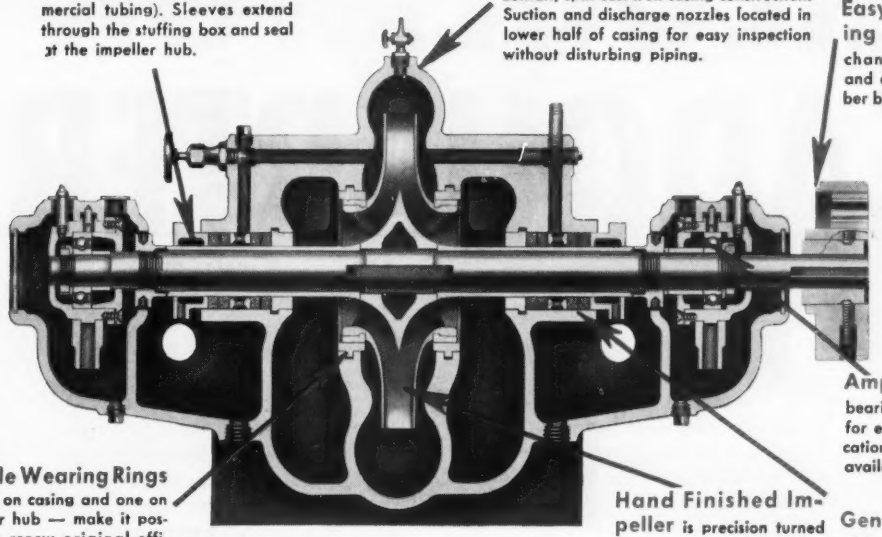
# Get 8 Advantages of GOOD PUMP DESIGN

ALLIS-CHALMERS Double-Suction PUMPS



**Longer Shaft Sleeve Wear** with cast shaft sleeves (not commercial tubing). Sleeves extend through the stuffing box and seal at the impeller hub.

**Greater Rigidity** with heavy horizontally split cast-iron casing construction. Suction and discharge nozzles located in lower half of casing for easy inspection without disturbing piping.

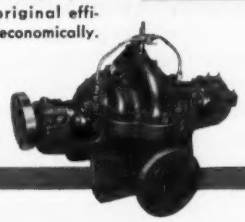
**Easy Coupling Mounting** with *Magic-Grip* quick change bushings for pump and drive shaft. Pin and rubber bushing type usually used.

**Ample Bearings** — Ball bearings may be furnished for either oil or grease lubrication. Split shell bearings also available in larger sizes.

**Double Wearing Rings** — one on casing and one on impeller hub — make it possible to renew original efficiency easily and economically.

**Hand Finished Impeller** is precision turned and carefully balanced to assure vibrationless operation and close wearing ring clearance.

**Generous Stuffing Box** with sufficient packing to keep stuffing box maintenance low. Provision made for sealing water connection or grease seal if required.



**Wide Choice of Materials** is available for all types of service — iron, bronze, stainless steel and combinations.

HEAVY DUTY CONSTRUCTION with no skimping, no corner cutting is what you'll find in Allis-Chalmers double-suction pumps. Extra metal thicknesses, extra strong parts, extra features and extra careful workmanship add up to long life, low maintenance, and low cost per gallon pumped.

Every Allis-Chalmers double-suction pump is carefully tested on the most modern testing equipment in the industry. Each installation is individually engineered by men whose experience in thousands of pump installations will give exactly the right pump for your needs. Stock sizes from 10 to 7000 gpm with heads to 475 feet.

### Complete Pumping Unit

Allis-Chalmers can furnish the complete installation — pump, motor, control and drive — all built of coordinated design and manufacture.

Whatever your pumping problem, call your A-C Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B6146.

A-4590

**ALLIS-CHALMERS**

FULTON SYLPHON

# TEMPERATURE REGULATOR HEADQUARTERS,

Customer confidence has made Fulton Sylphon a leading supplier of temperature regulators . . . indeed, headquarters for temperature regulator know-how. Consider this extra advantage to you before buying any regulator.

**You are confident** of the right regulator for your requirement! Fulton Sylphon offers a complete line of temperature regulators for industrial process control; engine controls; heating, ventilating and air conditioning . . . provides latest engineering advances in efficient, lower-cost temperature control.

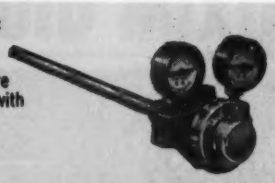
**You are confident** that the very finest engineering service is focused on your temperature control problem. Whether it involves field or plant engineering, your problem receives the prompt, specialized engineering service that only a leading supplier can afford to provide—without cost to you.

**You are confident** of dependable performance in the field. Fulton Sylphon Temperature Regulators are produced under the most rigid quality control standards. All parts are made by Fulton Sylphon to exacting, time-proved specifications. The diaphragm of each regulator is an all-metal Sylphon Bellows, originated by Fulton Sylphon and universally specified for the most critical military and industrial applications.

**You are confident** of competent, nearby field service. Fulton Sylphon technically trained representatives in 50 cities throughout the United States assure you of fast, on-call service.

Several types of Fulton Sylphon Temperature Regulators are described on the next page. For full information on these, and other types, use the convenient coupon.

**New Fultrol**—Thermostatic Pilot Controller No. 1100. Provides accurate control of liquids or air temperature when used in conjunction with valves, dampers, etc. Temperature ranges: 50°-250°F., 150°-350°F. Fast response. Low air or water consumption.

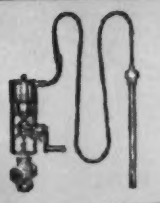


**New Bellows Motor Valve**—No. 992-D Series for final control element in pneumatic or hydraulic control systems to regulate flow of gas, oil, water or other liquids. Valve sizes ¼" to 4" inclusive. Ideal for use with Fultrol Thermostatic, Pilot Controller.

**No. 999 Temperature Regulator**—For accurate control of industrial process temperatures, storage water heaters, bottle washers, slashers, etc. Self-powered, sensitive, with over-temperature protection. Sizes ¼" to 4" inclusive.

**No. 923-C Temperature Regulator**—Extra large thermostat makes this unit more powerful than other self-operated regulators. Handles direct-operated valves on higher pressures and controls temperatures more closely. Sizes ½" to 6" inclusive.

U.S.A.



**No. 923-Q Regulator**—Quick adjustment type for controlling temperature of liquids, air or gases. For applications requiring frequent changes in temperature. Sizes ½" to 4" inclusive.

**For Internal Combustion Engines**—New Types 1280 and 1281 for control of cooling water or lubricating oil are powered by famous Fulton Sylphon Power-Pill thermostat units. Compact, easy-to-service, self-powered and simple to install.

**New Hot-Cold Water Mixer**—No. 1350 Series Mixers give an accurate, controlled source of tempered water. Unaffected by variations in water pressure. Failure of water supply automatically shuts off flow.

**New Steam-Water Mixer**—No. 1360 Series injects steam directly into the water, using every BTU of heat energy to bring water to a constant, pre-determined temperature. Steam is used only when water is drawn. Automatic shut-off if water supply fails.

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☐ Have your representative call for appointment

☐ Send literature describing Regulator Numbers: _____, _____, _____

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Company_____

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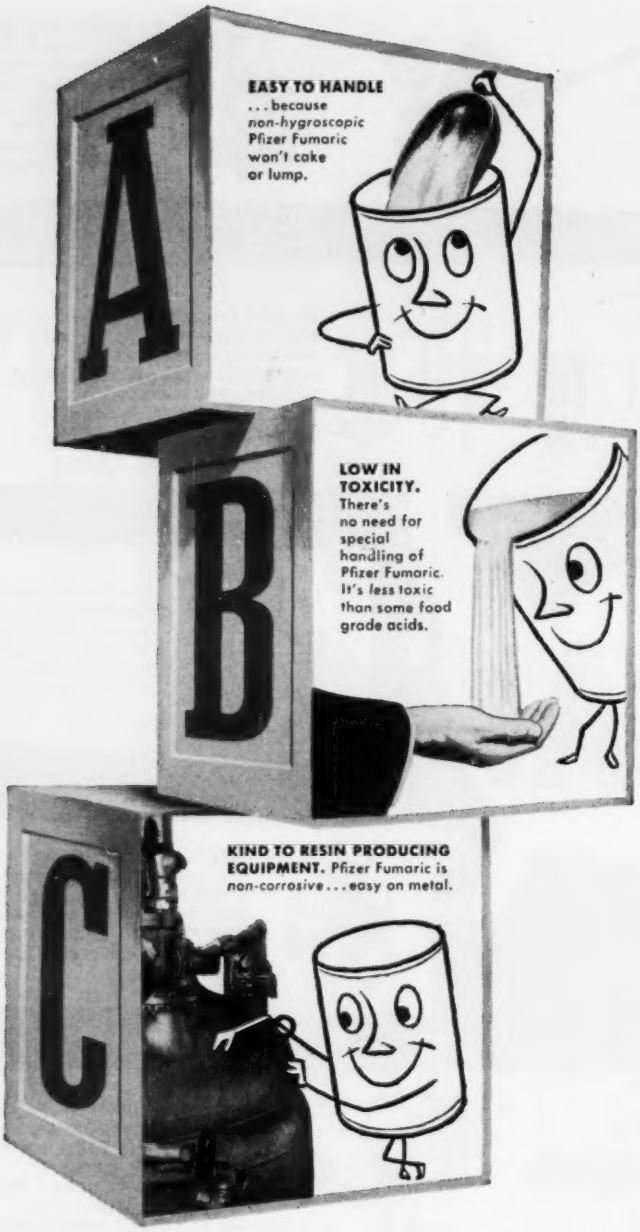
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...because non-hygroscopic Pfizer Fumaric won't cake or lump.
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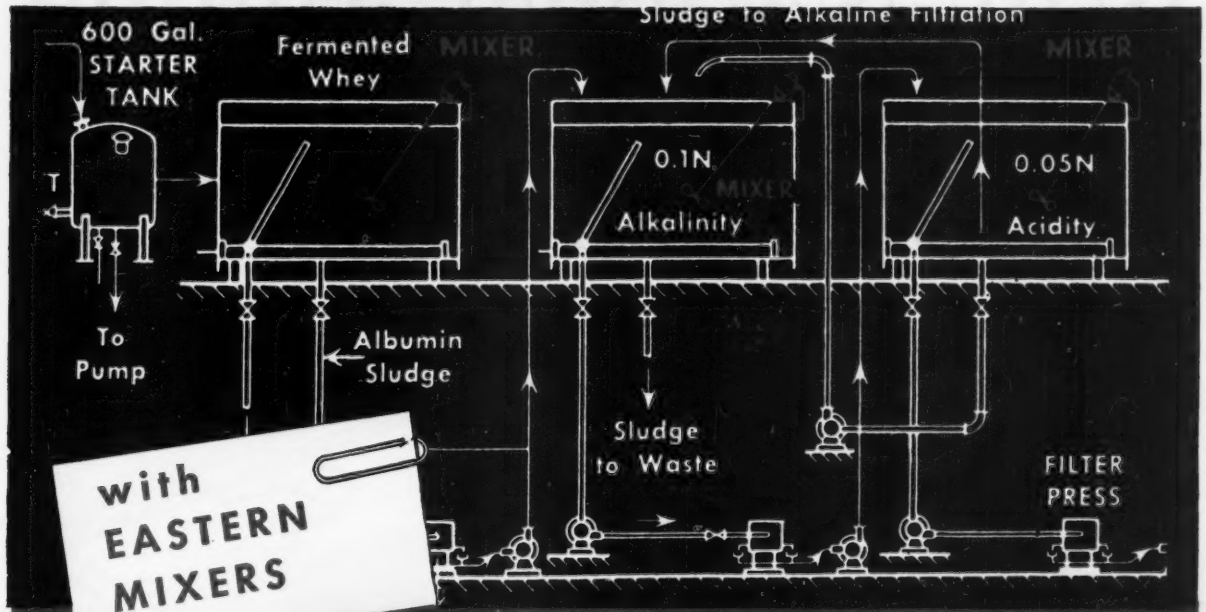
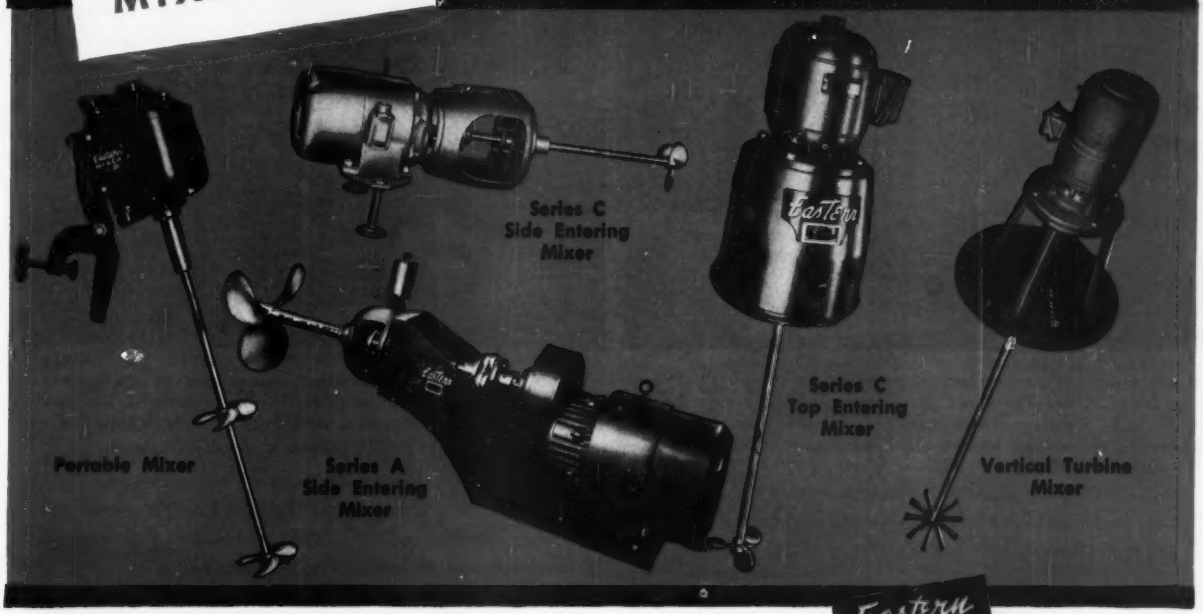




Series C Side Entering Mixer
Portable Mixer
Series A Side Entering Mixer
Series C Top Entering Mixer
Vertical Turbine Mixer

Eastern's Mixers are designed to meet the needs of today's chemical and industrial processes. Many types are available to satisfy all conditions of fluid consistencies and tank sizes. Selection may be made from a wide range of horsepower, speed, and construction materials. Motors with various voltage ratings and enclosures are also furnished.

## PORTABLE MIXERS

Series H at 1725 R.P.M., Series S at 1125 R.P.M., and Series G at 420 R.P.M. are available in motor ratings from 1/20 to 5 H.P. Also available are special speeds, variable speeds, as well as air driven models.

## TOP AND SIDE ENTERING

Series A, extra heavy duty for large tanks, are available in side entering units only within a range of 5-30 H.P. with standard speeds of 280, 420, and 1150 R.P.M.

Series C, for average tank capacities, are available in sizes of ¼ to 10 H.P. at these standard speeds: 1725 R.P.M. (up to 5 H.P.); 1140 R.P.M. (up to 10 H.P.); 420 R.P.M. (up to 7½ H.P.); 280 R.P.M. (up to 5 H.P.). Available in both horizontal and vertical models.

## TURBINE MIXERS

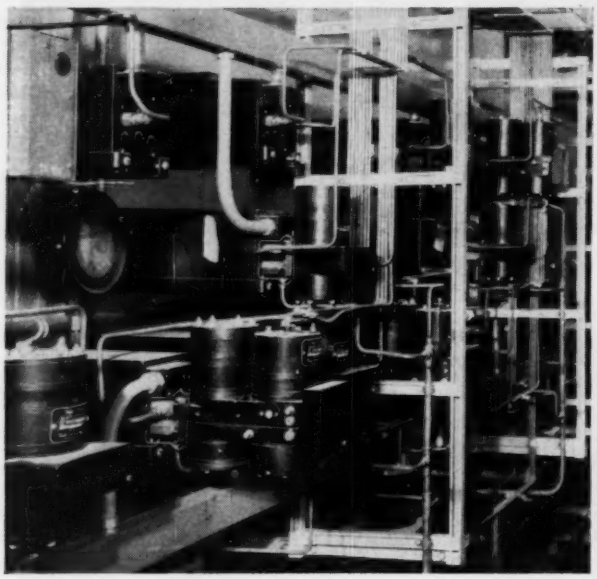
Eastern's Top and Bottom Entering Turbine Mixers find particular application where liquid blending requires gentle, yet thorough agitation.

Models are available in sizes from ¼ to 40 H.P. Standard speeds are 56, 68, 84, 100, 125, 155 R.P.M.

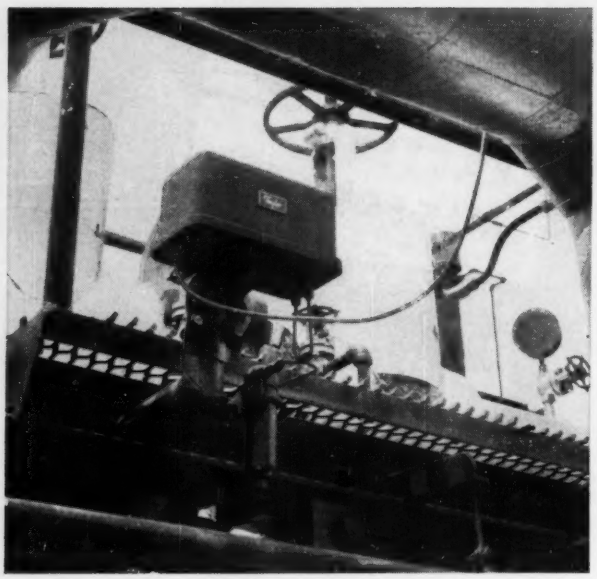
*For 3 bulletins covering Eastern Mixers, request Catalog Series 26.*

**Eastern INDUSTRIES, INC.**
**Mixer Division**
**Regent St., Norwalk, Conn.**

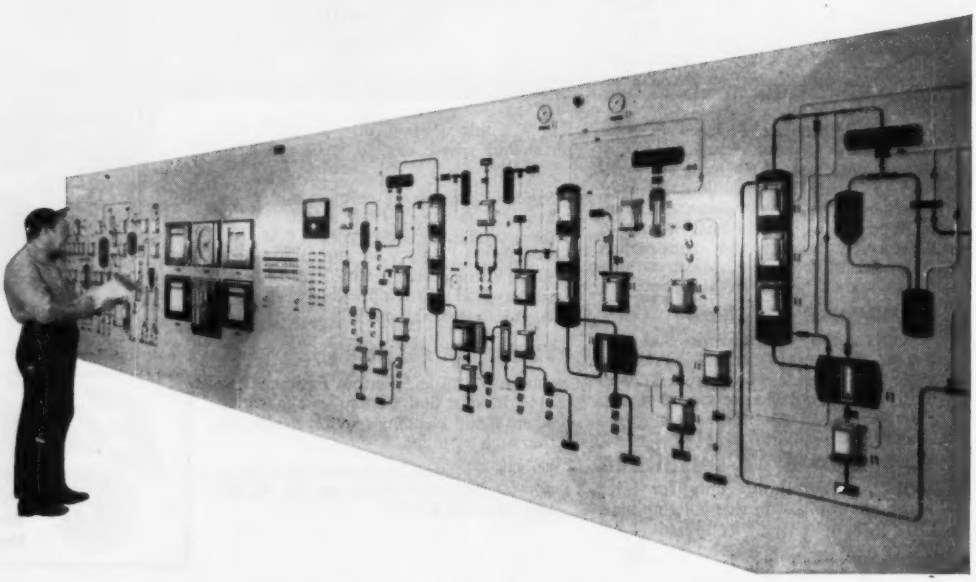
# Why National Aniline instrumentation for



Rear view of aniline distillation control board showing plug-in type BI-ACT* and TRI-ACT Controllers mounted on the back of 5" x 5" Receiver Recorders. This simplifies start-up and operating procedures and results have been most satisfactory.



Taylor TRANSAIRE Temperature Transmitter on hydrogen and nitro-benzine mixture on catalytic aniline section. Extremely fast speed of response and sensitivity give immediate indication of any change in conditions.



Aniline distillation control board. This type of graphic panel is, in effect, a giant flow diagram, available at all times to facilitate operator training. During the start-up period it helped eliminate much confusion as to the relationship of each variable in the process.

# selected Taylor its Moundsville plant

INSTRUMENTATION is considered a "basic ally" by the National Aniline Division of Allied Chemical and Dye Corporation. For their new plant at Moundsville, W. Va., the first continuous process plant to manufacture aniline, they had to have accurate measurement and very close control.

They also had a problem in coordinating and adjusting the many interrelated variables, since two of the processes are some distance apart. A centrally located control station was indicated, which in turn dictated the use of the TRANSET* transmitter system of control.

**Previous experience influenced decision**

Another important reason for selecting the TRANSET System was the great dependability of Taylor pneumatic transmitters and receiver controllers experienced by National Aniline at their Buffalo, N. Y., plant.

**TRANSET features important to National Aniline**

**1. Extremely accurate measurement.** The TRANSAIRE* Temperature Transmitter is highly responsive to dynamic temperatures, due to derivative action (SPEED-ACT*) in the measuring circuit and the low heat capacity of the cigarette-sized bulb.

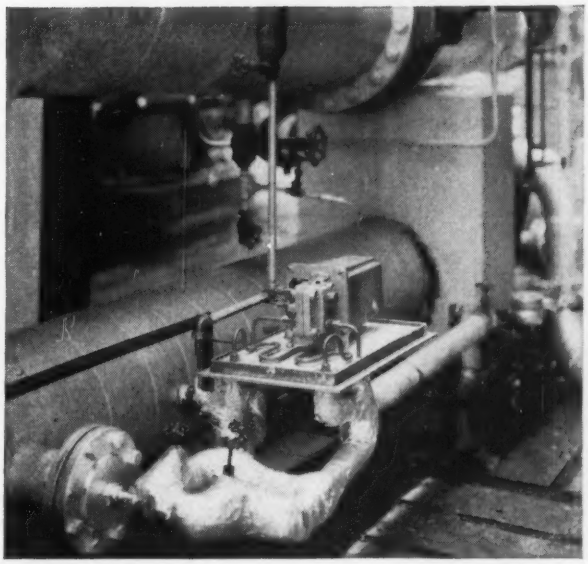
**2. Close control without overpeaking.** TRI-ACT* Controllers are designed to capitalize on the faster speed of response of the TRANSAIRE measuring elements to give optimum control quality. This insurance against overpeaking is particularly important in the processing of aniline.

**3. Minimum instrument down-time and easy maintenance.** The "Plug-in" feature of the TRANSET System minimizes interruptions due to instrument failure, because shop-adjusted instruments can be plugged-in within a matter of seconds. It simplified maintenance, since this can be done in the shop rather than on the panel.

This quick, easy interchangeability of all elements of the TRANSET System makes it possible to trace, analyze and correct process difficulties before serious trouble arises. It means money saved on installation because of simplified mounting, and fewer piping connections.

**National Aniline's Research and Engineering pay off**

The quality of the aniline product at the new Moundsville plant is of such a high order that National Aniline is now in process of doubling its present capacity. This is indeed a tribute to modern instrumentation, which gives the research chemist and the developing and process engineers accurate and dependable control of all variables.



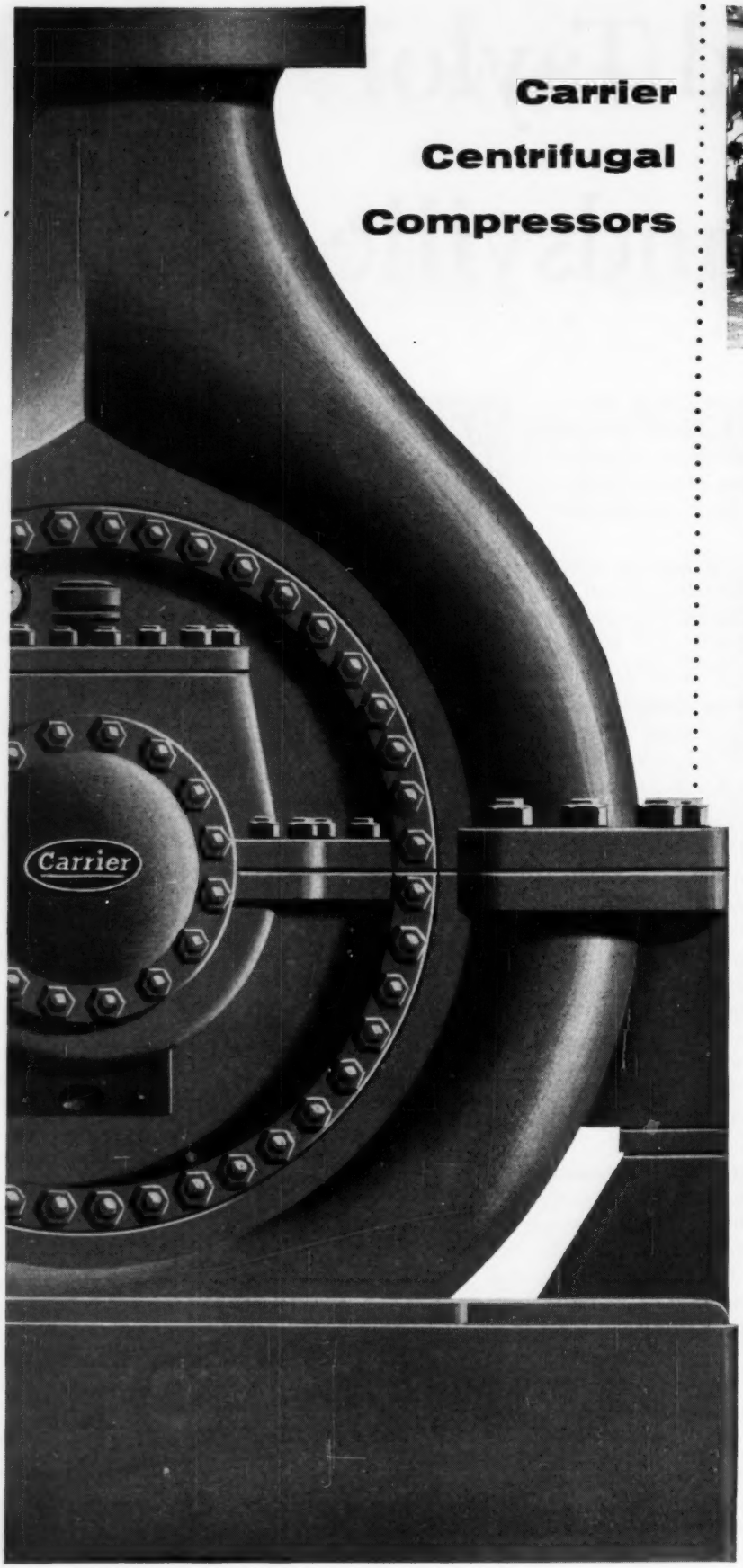
Taylor Differential Pressure Transmitter on Pitot tube application in the Maleic Anhydride plant. This plant also operates from a central graphic panel and has instrumentation similar to that of the aniline plant.

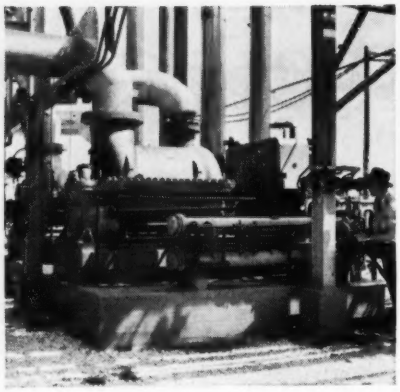
Your Taylor Field Engineer is fully qualified and experienced to advise you on your process control problems. Or write Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

*Reg. U.S. Pat. Off.

*Taylor Instruments*
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

# Carrier Centrifugal Compressors



## on the job at **Lion Oil Company**

Two Carrier Centrifugal Compressors are dependable links in the chain of operations at Lion Oil Company's Barton Ammonia Plant, Luling, La. Each compresses 8500 cubic feet of air per minute for burning with combustible gases in the secondary reformer furnace. Ammonia for synthetic fertilizer is the end product.

Carrier makes a complete line of centrifugal and axial flow compressors for gas compression and refrigeration—up to 10,000 hp in a single unit. Hundreds of these dependable, efficient Carrier machines are on the job at dozens of chemical plants and refineries across the country—Olin Mathieson Chemical Corporation, The Atlantic Refining Company, Wyandotte Chemicals Corporation, The Texas Company. May we assist you?

If you'd like a copy of our booklet, **"Centrifugal Compressors for Industry,"** please call your nearest Carrier office. Or write direct to Carrier Corporation, Syracuse, New York.

**Carrier**

**centrifugal compressors**
**refrigerating equipment**

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## PRESENT and FUTURE

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If you need one of these chemicals or one of the many others that Petro could manufacture, why not add this plant to your facilities. Our engineers will be glad to discuss your long-term bulk requirements for chemicals from Petro.

## NATIONAL PETRO-CHEMICALS

CORPORATION

*A joint enterprise of National Distillers Products Corporation and Panhandle Eastern Pipeline Company*

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# NEW **REPUBLIC** 5 **GAUGES**

*Individual, Independent Measuring Units for*
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*High Accuracy Receivers for Pnuematic Transmitters and Electric Meters Measuring*
**FLOW • PRESSURE • $CO_2$ • DENSITY • LIQUID LEVEL • OTHER PROCESS VARIABLES**

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- FIVE INCH ILLUMINATED SCALES
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- EASILY MOUNTED—no panel drilling necessary in most cases
- SCALES EASILY CHANGED OR COLOR-CODED
- POINTER MOTION REVERSIBLE
- SIMPLIFIED CONNECTIONS AT BACK OF CASE
- REMOVAL FROM FRONT OR BACK

Now you don't have to sacrifice instrument performance and readability to size considerations. With Republic's new line of small-size V5 Gauges, you can save panel space, make more compact instrument groupings and *still* get the accuracy, sensitivity and readability you would expect from conventional sized instruments. Full sized diaphragms, bellows and helix units in V5 Gauges assure "big" gauge performance in an instrument that requires only one-fourth the panel space of conventional gauges. Five inch scales are almost flat and are indirectly illuminated as a standard feature for easy reading — even from a distance.

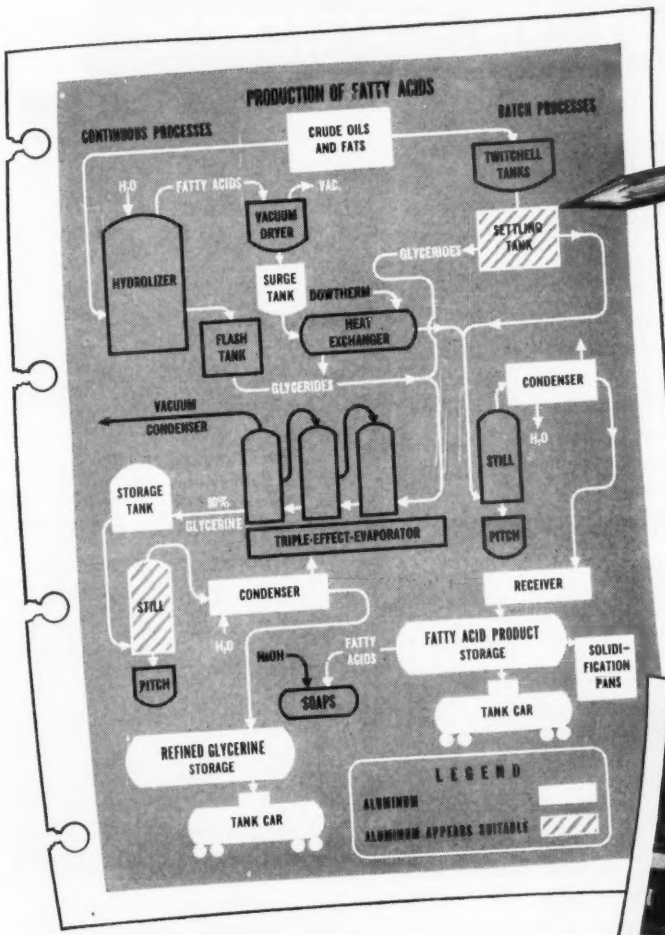
• ***Write for New V5 Bulletin*** ▶

**REPUBLIC FLOW METERS CO.**
**2240 Diversey Pkwy., Chicago 47, Illinois**

# Handling glycerine and fatty acids?

## Do it better, cheaper...with

# ALCOA ALUMINUM




FATTY ACIDS, ALCOA Aluminum tanks, piping, heat exchangers, shipping drums and tank cars are standard equipment for handling fatty acids. OLEIC ACID, for example, does not attack aluminum even at the boiling point provided a trace of moisture is present. Oleic acid is shipped in aluminum tank cars. FORMIC ACID solutions, when uncontaminated, have no appreciable action on aluminum at room temperature. ACETIC ACID is handled commercially in aluminum stills, condensers, piping, valves, receivers, storage tanks, shipping drums and tank cars. At room temperature, the rate of attack on aluminum by solutions of acetic acid does not exceed 0.001 ipy. Attack in dilute solutions varies directly with temperature. At the boiling point, however, the glacial acid is compatible with aluminum provided a trace of moisture is present.

**GLYCERINE** and its solutions have no action on ALCOA Aluminum. Aluminum stills, condensers, heat exchangers, receivers, piping, storage tanks and tank cars (as shown) are in service with natural and synthetic glycerine.

**FOR MORE INFORMATION** on the use of ALCOA Aluminum in handling glycerine and hundreds of other products, write today for our new FREE, 80 page book, *Process Industries Applications of Alcoa Aluminum*. Contains the latest production and design data.

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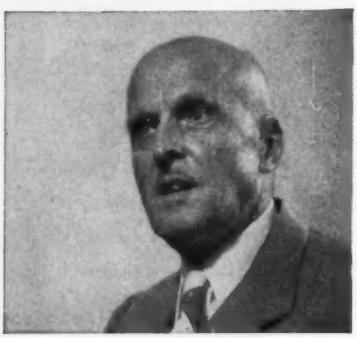
**J. S. Joseph**
**Chief Project Engineer**
Graduate of University of Delaware
Graduate of Princeton University
**11 Years of Engineering Experience**

**C. W. Fisher**
**Ass't Department Manager**
Graduate of Northern Normal Industrial School
Graduate of University of Michigan
**15 Years of Engineering Experience**

**C. E. Shaffer**
**Special Engineer**
Graduate of Colorado College
**29 Years of Engineering Experience**



**Max Josenhans**
**Special Engineer**
Graduate of the University of Berlin—Charlottenburg
**37 Years of Engineering Experience**

If you are planning the construction of a new chemical plant, you can enlist the wide and diversified experience of these engineers. They are key members of Koppers Chemical Department.

These men specialize in designing, engineering and constructing chemical plants—small or large, simple or complex. They will build pilot plants and, at a later date, commercialize them.

Among the many types of plants available to the chemical industry through the Chemical Department are ethylene, light oil hydrogenation, phthalic anhydride, tar distillation and refining, and anhydrous ammonia.

In addition to design and construction services, these specialists in many fields will conduct your engineering studies, make an economic appraisal of your plans, or survey a market in which you are interested.

Feel free to consult with this Department at any time, on any construction problem. You incur no obligation. Your inquiry is cordially invited.

**Koppers Company, Inc., Engineering and Construction Division, Chemical Department, Pittsburgh 19, Pa.**

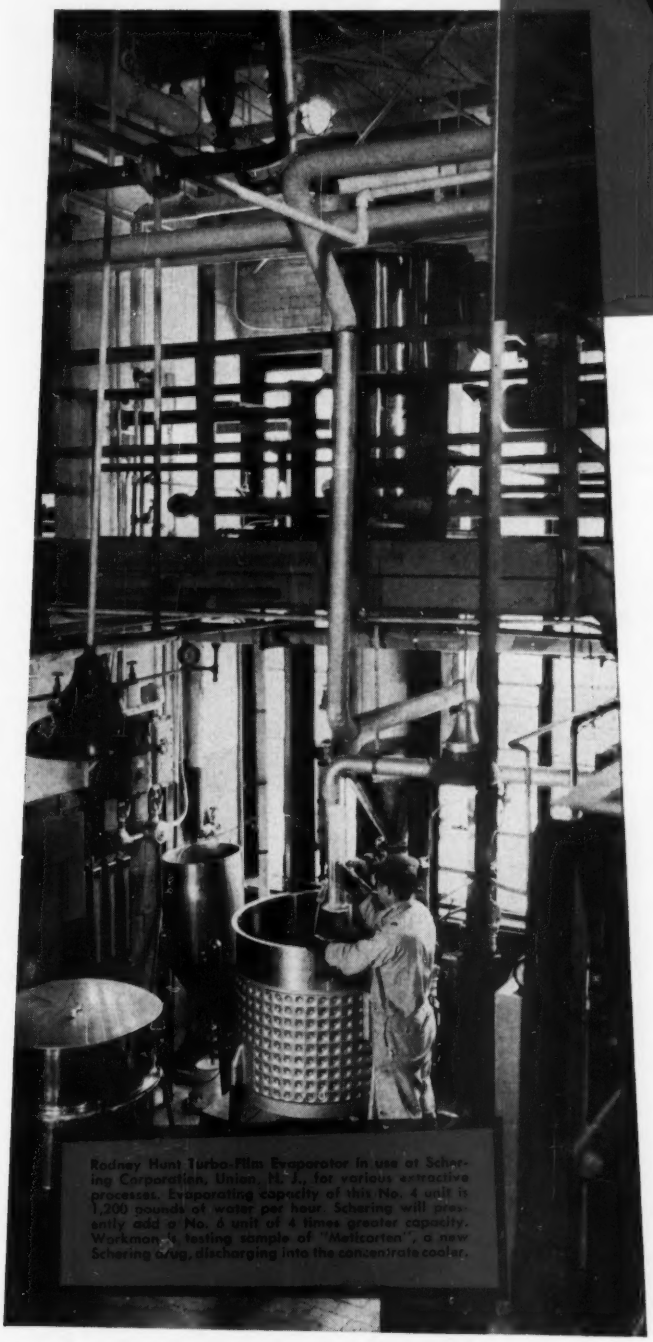
KOPPERS®

## CHEMICAL ENGINEERING SERVICES

# schering NOW BENEFITS BY:

HIGHER CONCENTRATION • LOWER CYCLE TIME • GREATER YIELD

## with turba-film evaporator



Rodney Hunt Turba-Film Evaporator in use at Schering Corporation, Union, N. J., for various extractive processes. Evaporating capacity of this No. 4 unit is 1,200 pounds of water per hour. Schering will presently add a No. 6 unit of 4 times greater capacity. Workman is testing sample of "Meticortan", a new Schering drug, discharging into the concentrate cooler.

Schering Corporation, manufacturer of fine pharmaceuticals in Bloomfield, N. J., has concluded 8 months of favorable experience with the Turba-Film® Evaporator. Typical of numerous operations is the evaporation of chloroform from solution during a feed-to-product reduction of approximately 35 to 1 and 15 to 1 on successive passes (total reduction over 500 to 1).

Evaporation is done atmospherically at temperatures below 100°C. The small amount of material in process at any given moment minimizes the hazards of handling a highly heat-sensitive product.

What was once a batch operation is now semi-continuous . . . and the Turba-Film Evaporator occupies only a tenth of the space required for batch operation! Schering is multiplying its Turba-Film Evaporator capacity by the addition of a No. 6 Turba-Film unit of 5000-gallons-per-hour capacity.

This is another example of Turba-Film Evaporator's capacity to expedite processing. Literature is available on request. Write us concerning your product or process, and arrangements for testing your product on our pilot plant.

RODNEY HUNT®

**RODNEY HUNT MACHINE CO.**

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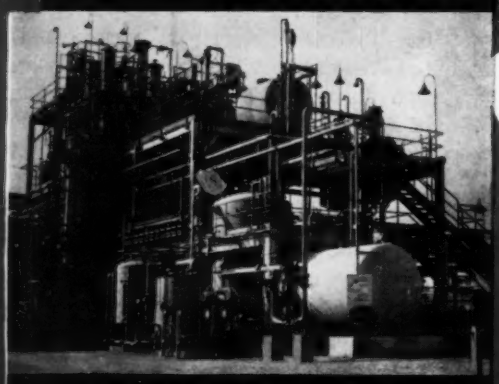

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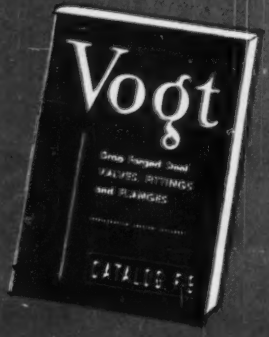


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DECEMBER 7, 1955

# Chemical Engineers Invade the Market Place

ONCE UPON A TIME, many years ago, the chemical engineer's place was in the laboratory. Only an occasional job of trouble shooting took him into the plant to help out the so-called "practical" men who ran the works. Sales and other white-collar and front-office jobs were largely the domain of the non-technical "business" man. Gradually over the years all this has changed for the better—for industry and for the chemical engineering profession.

As more and more laboratory processes were translated into profitable production, chemical engineers have largely taken over plant operations. As science and technology advanced, selling became more difficult. Technical service, market research and product development called for chemical engineers. So did management and administration of increasingly complex chemical enterprises.

To recognize and honor those companies that had encouraged this "broader participation of the chemical engineer in the affairs of the process industries," an Award for Chemical Engineering Achievement was established in 1933. Farseeing members of the first award committee insisted on defining chemical engineering achievement as:

> The successful, large-scale, *commercial* development of a process or group of processes or an entire company's business, based on research and actively developed, designed and operated by chemical engineers.

Since 1933 a dozen companies—or whole industries—have been honored for their achievements in the development, design and operation of great plants and processes. But this year's committee of senior chemical engineering educators under the chairmanship of Professor Walter G. Whitman has, for the first time, focused attention on equally important *commercial* contributions of chemical engineers in building a new American chemical industry—silicones.

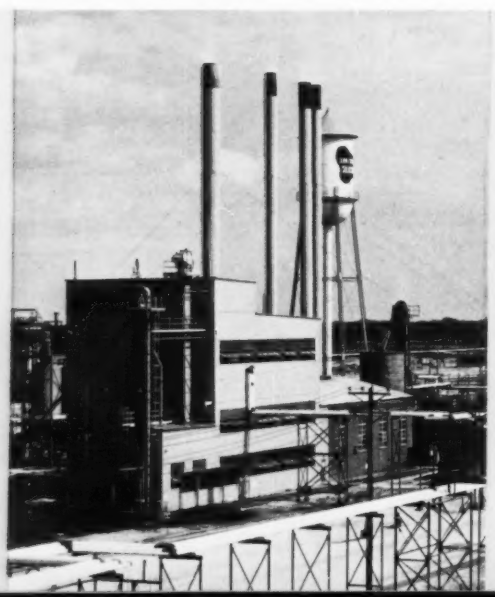
In selecting the Dow Corning Corporation for the 1955 Award, the committee thus recognizes effective teamwork in the broad field of commercial development—in market research, product engineering, technical sales. Here, to be sure, was a firm foundation of brilliant research, going back nearly twenty-five years in Corning laboratories and 15 to 20 years in those of Dow Chemical and Mellon Institute. Here, too, were pilot plants, hastily built for war production of these unique organo-silicon products, these queer hybrids of the organic and mineral kingdoms. Later, and in ever increasing size, have come large-scale, efficient plants embodying the best of chemical engineering technique and equipment.

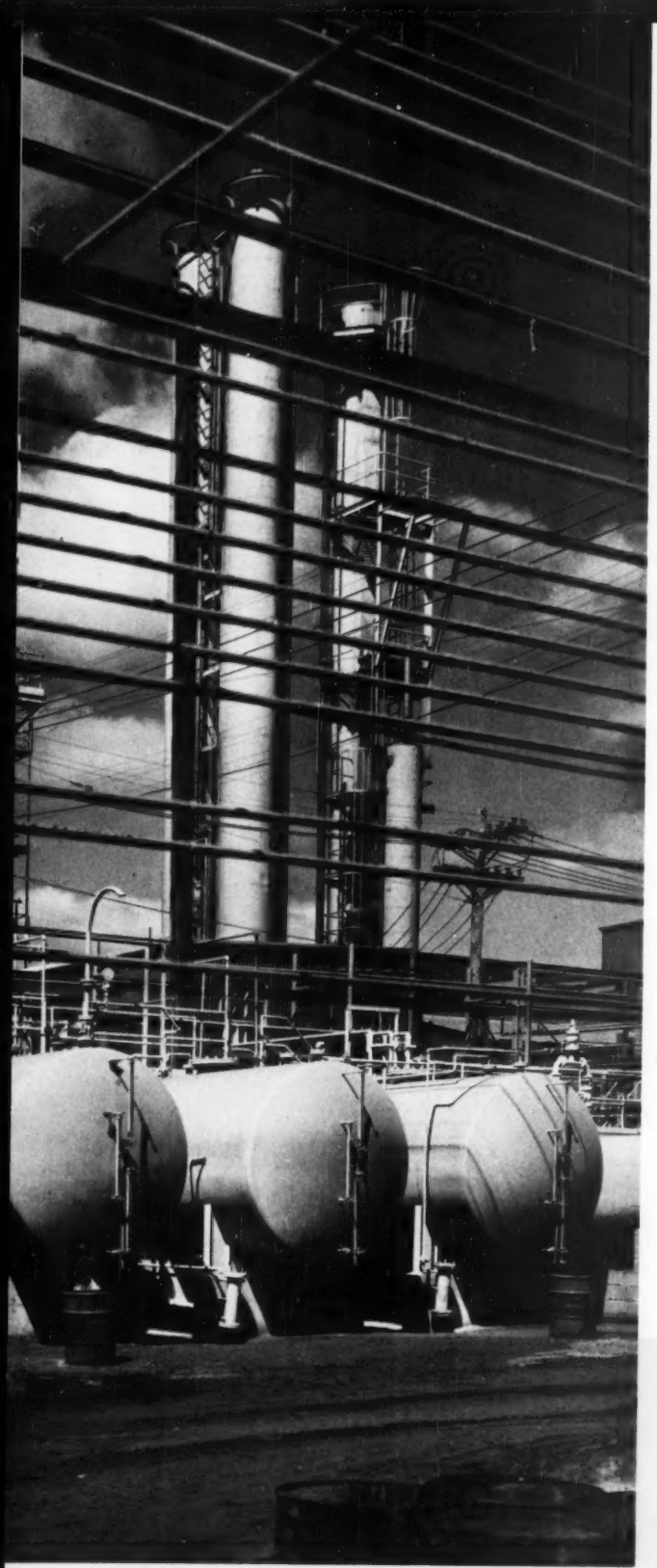
Yet making silicones in commercial quantities is only part of the Dow Corning achievement. There would have been no silicone industry had it not been for the development of literally hundreds of useful applications of these materials of such unusual chemical and physical properties. Today there is scarcely an industry that has not benefited in some measure as the result of the commercial development of over two hundred silicone products.

This remarkable progress, which in 12 years has burgeoned sales from $15,000 to over $2,000,000 a month, is due in large measure to the teamwork of resourceful chemical engineers and other technically trained personnel. Thus in honoring Dow Corning Corporation with the 1955 Award for Chemical Engineering Achievement, the Committee gives deserved recognition to chemical engineering's victorious invasion of the market place. Successful large-scale *commercial* development has proved its right to a place in the ranks alongside of research, engineering, production and management.

Sidney D. Kirkpatrick

SIDNEY D. KIRKPATRICK
*Secretary, Committee of Award*





# 1955 Committee of Award for Chemical Engineering Achievement

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Meeting in Corning, N. Y. in 1945, Drs. Rob Roy McGregor, Edgar C. Britton, James Franklin Hyde, William R. Collings, Eugene C. Sullivan, thoughtfully appraise some products of their wartime researches — the ultimate bases of a new and vigorous industry

## CHEMICAL ENGINEERING TEAMWORK OPENS

# A New Era in Silicones

**By Sidney D. Kirkpatrick,** Editorial Director of *Chemical Engineering* and *Chemical Week*

LIKE MOST SUCCESS STORIES in the chemical industry, this one also starts with research. For the first ten years or so it was "pure" research, with little prospect of commercial application. Then came an urgent war need for a product of peculiar physical and chemical properties and in February, 1943, the sponsors of that early research joined with an equally resourceful chemical company formally to launch the Dow Corning Corporation—and the American silicone industry.

One measure of the success of that joint enterprise of the Corning Glass Works and The Dow Chemical Company is that the one product so badly needed by the U. S. Government in 1942 has since spawned a family of more than 200 organo-silicon products. Another is that the industrial uses, non-existent in 1942, now number more than a thousand. There is scarcely an industry that has not gained something from this prolific union of scientific research and successful commercial development. How that teamwork has opened a new era in silicones is the story of an outstanding chemical engineering achievement.

But first let's get back to the research laboratories of the Corning Glass Works in 1930. Breaking with the traditions of his industry, the eminent Perkin medalist, Dr. Eugene C. Sullivan, persuaded his colleagues to hire one of Roger Adams' organic chemists from the University of Illinois. The new chemist, James Franklin Hyde, had been doing post-doctorate research on chlorophyll under James B. Conant at Harvard; but he eagerly turned to the even greener field of the organic derivatives of silicon. The object was to see if he might find a glass-like plastic or at least something useful with glass. The results of Frank Hyde's researches during the next few years were more like organic resins than like glass. Yet these new organo-silicon oxide hybrids did show some unusually interesting properties, particularly in their thermal stability and resistance to oxidation.

About this time the electrical industry was experimenting with glass fiber for higher temperature electrical insulation and needed a bonding resin that would withstand such severe service. Dr. Sullivan was convinced that among Frank Hyde's

test-tube rack of resinous silicone products, one could be found that would cure tack-free and still stay flexible on glass tape after long exposure to high temperatures.

Corning also had another string to its bow, for the company had established a fellowship at Mellon Institute, where a doughty Scotch-Canadian, Dr. Rob Roy McGregor, was working on adhesives for glass building blocks. He decided to find out if methyl groups attached to ethyl ortho silicate would give products that improved adhesion. This research was not immediately successful, at least for the intended purpose, but did produce a most interesting series of water-white silicone fluids. They too were characterized by remarkable ability to remain relatively unchanged at low or elevated temperatures and, in addition, were exceptionally resistant to moisture.

It was then that Corning turned to Dow and particularly to Dr. Edgar C. Britton whose mastery of the classic Grignard reaction was to provide the key for a successful manufacturing process. Application research carried on by Dr. Shailer L. Bass and his co-workers in the Dow Cellulose Products laboratory came up with an exciting use for the first silicone fluid to come from the Dow pilot plant. They found that because of its temperature characteristics and dielectric properties the new fluid was an ideal material to use in an ignition sealing compound for spark plugs in military aircraft engines. The Army Air Corps wanted all the product that could be turned out by the first production group, headed by Howard N. Fenn (B.S. in Chem. Engr., Yale Univ. 1928.)

So the stage was set for a deal. Corning Glass Works offered to throw in its research if Dow would join in setting up an equally owned company. Dow agreed to contribute its chemical engineering know-how and manufacturing experience. Both companies would invest equal amounts of money and share in its management. Dr. Sullivan of Corning was to be the first president and Dow's William R. Collings, a 1916 chemical engineering graduate of Case, was appointed executive vice president and general manager.

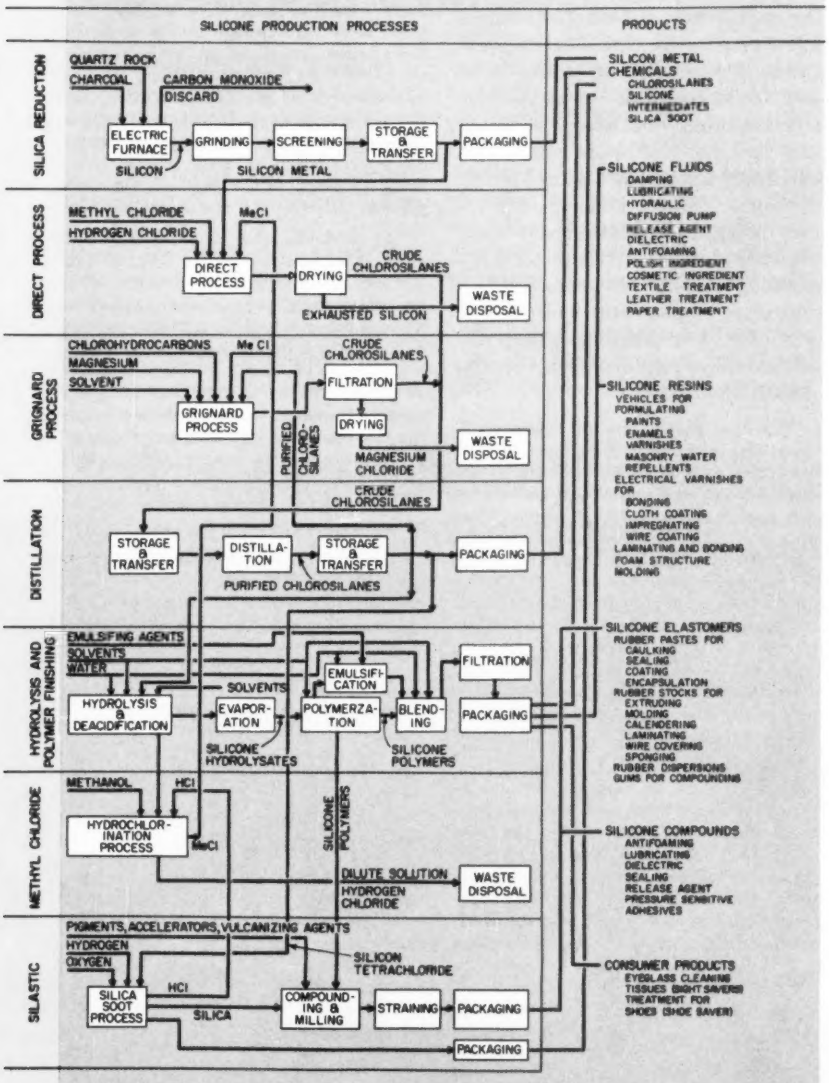
When the Dow Corning Corporation was formally organized in February, 1943, it had already been in production for six months with its first silicone, Dow Corning 4, made by the Grignard process in the pilot plant at Midland. In September, 1943, Captain (now Admiral) H. G. Rickover had become convinced that a silicone bonding resin offered the only practical solution to high temperature electrical insulation. Through his insistence the Navy ordered the necessary priorities that permitted construction of the first commercial plant for silicone manufacture. This was completed late in 1945.

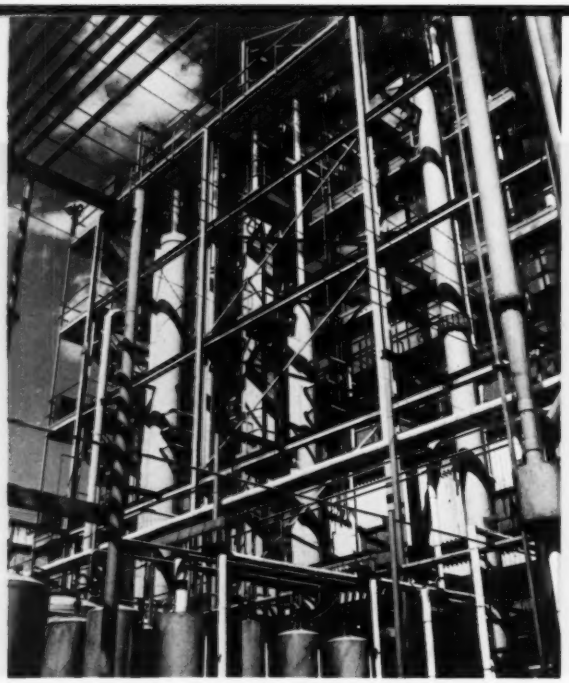
But just about a year after that the thriving little enterprise took a terrible nose dive. When the war ended, Dow Corning's business stopped abruptly—but not for long.

The laboratories at Mellon and Midland had continued and greatly expanded their application research. Their trump cards – thermal stability and oxidation resistance – won scores of patents for hundreds of end uses. Many new products were developed in the laboratories and patiently tailored to fit the exacting requirements of customer industries. Meanwhile a high order of chemical engineering talent was being applied to develop more efficient manufacturing processes.

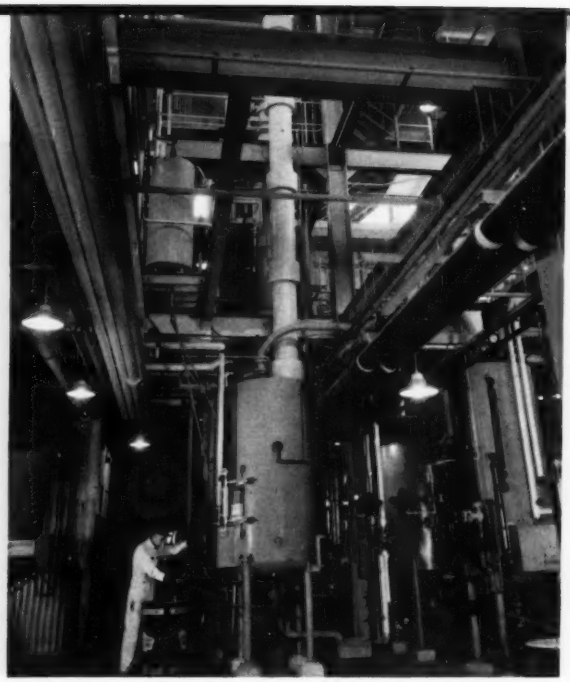
Thus Dow Corning's temporary setback was soon reversed and growth resumed. Progress in the past twelve years has been phenomenal, even for the chemical industry – a growth rate of 40 percent per year compared with 9 percent for most chemical industries, 3 percent for American industry as a

## How Silicones Are Made and Used





**These high-temperature, high-vacuum, pilot-plant fractionaters are automatically controlled by differential-pressure actuated valves, which govern flow of heat-transfer medium**



**Organo-silicon chlorides, basic intermediates for silicones, are continuously fractionated in these tall towers that dominate the world's first and largest manufacturing plant**

whole. Another measure of technical progress has been the reductions in the selling prices of silicone products of as much as 40 percent during a period in which prices in general have been rising steadily.

The accompanying flow chart presents an over-all picture of Dow Corning's manufacturing processes and some of the end uses for the products. It was prepared for the Chemical Engineering Award Committee by a representative group of young chemical engineers – themselves members of the research, production and distribution team. Here they are and the schools from which they came:

Robert E. Greenhalgh – B.S. Chem. Engr., Univ. of Michigan, 1947. Project Engineer & Group Leader, Design Engineering Dept.

William J. Hargreaves – B.S. Chem. Engr., Michigan State. 1946. Manager of Technical Employment, Personnel Department

Wayne E. Barrett – B.S. Chem. Engr., Case Institute, 1944. Project & Development Engineer, Production Department

Earl W. Beck – B.S. Chem. Engr., Univ. of Toledo, 1948. Project Engineer, Pilot Plant Production, Research Dept.

William C. May – B.S. Chem. Engr., Purdue University, 1950. Assistant Manager, Fluids Section, Product Engineering Dept.

Joseph F. Dellaria – B.S. Chemistry, Grove City College, 1951. Assistant Product Manager, Silastic Sales

Dr. Collings, who succeeded to the presidency of Dow Corning in 1954, once said that "Selling silicones is primarily an educational job. We've got to show our prospective customer just what our products can do, and most important, what they can do for him in his own process or plant." To carry forward that program has called for ever-expanding roles for chemical engineers in market research, product and sales engineering. Here is the way the Dow Corning group described these responsibilities for the Award Committee:

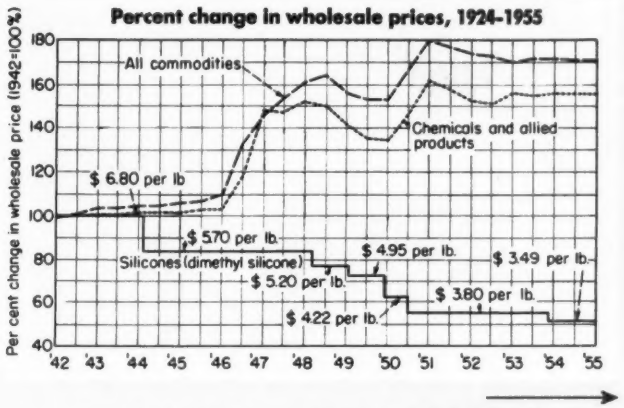
"We have shown how the more traditional phases of chemical engineering have been employed by Dow Corning in research, design and production. But that is only part of the story. Dow Corning differs from the traditional chemical company in that it has always had to produce finished or semi-finished products. In the beginning there were no known uses for the intermediate products. They were, therefore, of no economic value until they were converted to finished products with specific uses, established by extensive laboratory testing and evaluation.

"Furthermore because silicones are inherently more expensive, frequently costing several times as much as the organic materials they displaced, it was necessary from the outset to prove their economic advantages. In some cases, markets were found for silicone products because they were effective in much lower concentrations than the materials previously used. In some cases, the use of silicone products reduced maintenance, replacement or machinery costs to such an extent that they saved more than enough money to justify their higher initial cost. In other cases, the use of silicones resulted in such a marked improvement in the performance or life of an end product that the added cost was negligible compared with the competitive advantage gained by their use. In other cases, the design of new products was made possible only through the use of silicones.

"An understanding of chemistry and engineering was required to develop such silicone products and to establish their usefulness from an engineering as well as an economic point of view. Many chemical engineers have been involved in that operation. Some of them are called technical sales representatives. They must recognize potential areas in industry where silicones may be used; also how that usage may affect manufacture. Others are called product and development engineers. Although they work in different areas one cannot function without the other.

"Such product development engineers are faced with designing new formulations, new methods of compounding, new methods of fabrication, new analytical procedures and new methods of testing. At Dow Corning literally hundreds of ideas for new uses of silicones, many originating from customer's questions, are being investigated in a dozen product engineering laboratories. Thus making silicones in commercial quantities is only part of our job. They must be produced in a chemical and physical form to perform a useful function or they are of no value.

"Thus the work of chemical engineers in technical sales and product development is an ever-expanding role in the silicone industry."




**How chemical engineers and other technical personnel are distributed throughout Dow Corning organization**

| | Chem. Engrs. | Chemists | Elect. Engrs. | Mech. Engrs. | Civil Engrs. | Textile Engrs. | Met. Engrs. | Others | Total |
|---|---|---|---|---|---|---|---|---|---|
| Administration .. | 1 | 1 | | | | | | | 2 |
| Patent & Legal.. | 1 | 2 | | | | | | | 3 |
| Advertising .... | 1 | | | | | | | | 1 |
| International ... | 4 | 4 | | | | | | | 8 |
| Market Research. | | 1 | | 1 | | | | | 2 |
| Accounting ..... | 1 | | | | | | | | 1 |
| Plant Mng't .... | 3 | 1 | 1 | 1 | | | | | 6 |
| Analytical ..... | | 12 | | | | | | | 12 |
| Design Engr. ... | 10 | 1 | 2 | 3 | 1 | | | 1 | 18 |
| Construction & Research Labs... | 21 | 33 | | | | | | 1 | 55 |
| Maint. Engr. .... | | | 1 | 4 | 5 | | | | 10 |
| Product Engr. .. | 28 | 21 | 3 | | | | | 2 | 54 |
| Prod. Dept. .... | 18 | 2 | 1 | 1 | | | | 1 | 23 |
| Sales Dept. .... | 28 | 16 | 19 | | 1 | 3 | 1 | 9 | 77 |
| **TOTAL** | **116** | **94** | **27** | **10** | **7** | **3** | **1** | **14** | **272** |

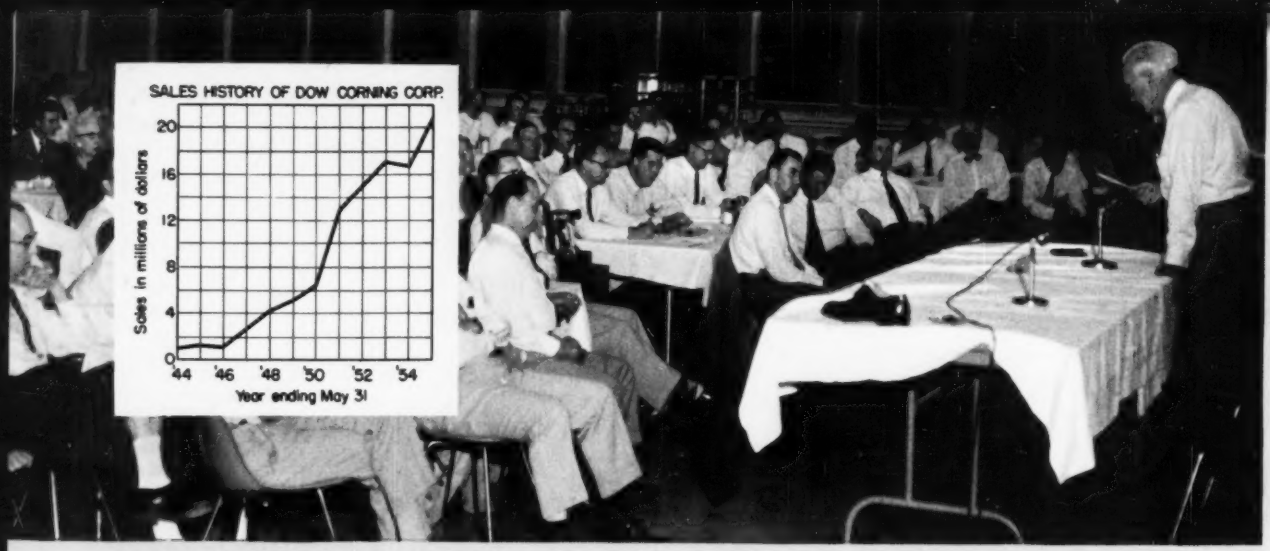
The 116 chemical engineers came from 42 different colleges. The 272 college graduates represent 103 different colleges and comprise 24% of the total number of employees at this time (1125).

# The Story of Sylflex

To demonstrate how this kind of chemical engineering teamwork has resulted in the development of an important new silicone product, Dr. Collings recently suggested an unusual program for the annual dinner meeting of the Dow Corning supervisors. He asked a working committee headed by R. W. Caldwell (B.S. Michigan State, 1938) to organize a series of panel discussions in which representatives of each division of the company would answer questions about their contributions to the successful development of Sylflex, the new leather treatment that promises to revolutionize one of the world's oldest industries. To put the boys on their toes, Dr. Collings invited a friendly but critical tanner and a shoe manufacturer to join in the informal discussion.

Bill Caldwell, who is plant manager, and C. E. Sanford (B.S. Univ. of Michigan, 1929) of sales, led off with the early history of the project. Back in 1944 they had been working with that first silicone product, Dow Corning 4, as a stopcock grease and valve lubricant. They decided to try it out as a water repellent for their hunting boots. With several others they waded in the mud and tramped through fields of slushy snow. Dow Corning 4 kept the boots soft and pliable under the most severe conditions and permitted the leather to "breathe," but it was only slightly better than conventional boot greases as a water barrier. Then the search began for a silicone

**These members of a typical panel tell of the teamwork behind a successful silicone development — R. W. Caldwell for Production, W. C. Blackburn for Patents, A. W. Rhodes for Market Research, H. J. Fletcher for Pilot Plants and C. E. Sanford for Sales**




**President William R. Collings tells Dow Corning supervisors how clearly the story of Sylflex illustrates the essential role of teamwork as the motivating force behind the climbing sales figures of a new and growing industry**

water repellent that would be many times more effective.

Melvin J. Hunter (Ph.D., McGill Univ., 1939) told how his research laboratories by continuing for seven years to develop various silicones, finally came up with a product that seemed to meet all requirements of the leather industry. Then T. A. Kauppi (B.S., Brown Univ., 1933) who had come over with Shailer L. Bass (Ph.D., Yale Univ., 1928) from the cellulose products laboratory of Dow Chemical and C. C. Currie (B.S., Alma College, 1939) and F. L. Dennet (M.S., N. Y. State College of Forestry, 1939) of product engineering took over the laboratory product. After making and testing thousands of different formulations, they finally developed a process that makes leather resist water penetration for several thousand flexes.

This was most encouraging. But just having a wonderful product doesn't mean that the job is finished. The talents of many more people were brought into action to complete commercial development. W. C. Blackburn (B.S., State Univ. of Iowa; L.L.B., Georgetown Univ., 1935) of the legal and patent department told the supervisors how much work was involved in drawing up and processing the necessary patents to protect the company's rights to manufacture, market and sell the now trademarked product, Sylflex.

A. William Rhodes (B.S., M.B.A., Univ. of Michigan, 1940) told how his market research department had to measure the potential market for the new product and to study where and how to market the goods. H. J. Fletcher, (M. S., Cornell Univ., 1941) described the work of the men in the pilot plant to develop a process to manufacture Sylflex economically in large volumes.

H. L. Browne (Houghton School of Tech.) and his group had to design and develop a machine to tan leather with the new materials and then supply a number of these machines to cooperating tanneries.

C. E. Sanford then returned to the program to tell of the trials and triumphs of the sales department under the direction of Dow Corning's pioneering sales manager, O. D. Blessing (A.B., Ohio State Univ., 1930). Customer resistance in an industry as conservative as leather tanning was only to be expected. Blessing told about the organization he had set up to convince tanners and shoe manufacturers that the product was good enough for commercial use – that Sylflex would repel water, make shoes last 50 percent longer, feel softer, and be more scuff and wrinkle-resistant.

L. S. Putnam (A.B., Yale Univ., 1930), advertising manager, explained the campaign his group had mapped out to educate the tanners, the shoe manufacturers, the retailers, and even us shoe wearers. Then he took the wraps off a new do-it-yourself silicone leather treatment, "Shoe Saver" – the consumer product Lou claims is best for home treatment of golf shoes, hunting boots and footwear in general.

A final panel gave the Dow Corning supervisors a first-hand picture of the customers' reaction to the meeting. The guest panelists were both from Red Wing, Minnesota – Charles Foley of the S. B. Foot Company representing the tanners of top quality leather and W. D. Sweazy, president of the Red Wing Shoe Company, representing the shoe manufacturers.

W. T. Rossiter (B.S., Case Institute, 1951), moderator for this panel, summed up the guests' reaction in these words: "These people represent our customers and our customer's customers. They tell us they did not realize how many years and how much effort it had taken to develop, manufacture, promote and sell this product. I'm positive that if they weren't 100 percent sold on Sylflex before they came, they were after hearing our program."

The story of Sylflex, presented here – some of it in the words of its chief participants – is typical of the development of many successful silicone products. It is also a case-study in teamwork and group effort in a live, progressive, and growing chemical company. As such it has provided an ever-broadening opportunity for chemical engineers not only in their traditional roles in research and production but also in equally challenging fields of product and sales development, management and administration.

F. C. Jelen's recent articles on capitalized costs have elicited many comments from CE readers. Here is a letter from G. C. Lammers, and . . .

Lammers says:

*"Annual cost method is more straightforward and less cumbersome than capitalized cost method."*

Jelen replies:

*"Capitalized cost method avoids the confusion and errors often found in annual cost analyses."*

**Analysis of Pump Replacement Problem by Annual Costs**

**Case 1—Sells after 1 year for $250**

| Amount, $ | Years | Factor from Table | Table No. | Annual Cost, $ |
|---|---|---|---|---|
| 1,000 | 1 | 1.08 | 5 | 1,080 |
| 700 | 1 | 1.08 | 5 | 756 |
| −250 | 2 | 1.1664 | 1 | −292 |
| 3,800 | 5 | 0.2505 | 5 | 952 |
| 400 | 1 | 1.08 | 5 | 432 |
| 3,800 | 5 | 0.2505 | 5 | 952 |
| 400 | 1 | 1.08 | 5 | 432 |
| Total for 3 years | | | | 4,312 |

**Case 2—Sells after 2 years for $100**

| | | | | |
|---|---|---|---|---|
| 1,000 | 2 | 1.1608 | 5 | 561 |
| 700 | 1 | 1.08 | 5 | 756 |
| 1,000 | 2 | 1.1608 | 5 | 561 |
| 800 | 1 | 1.08 | 5 | 864 |
| −100 | 1 | 1.08 | 1 | −108 |
| 3,800 | 5 | 0.2505 | 5 | 952 |
| 400 | 1 | 1.08 | 5 | 432 |
| Total for 3 years | | | | 4,018 |

**Case 3—Sells immediately for $1,000**

| | | | | |
|---|---|---|---|---|
| 3,800 | 5 | 0.2505 | 5 | 952 |
| 400 | 1 | 1.08 | 5 | 432 |
| Total for 1 year | | | | 1,384 |
| Total for 3 years | | | | 4,152 |

Should be −270

Lammers should correct to zero time, thus

**Corrected Analysis of Pump Replacement Problem**

**Case 1 (on a 2-yr. basis)**

| Amount, $ | Annual Cost, $, per Lammers | Year When Incurred | Cost Corrected to Zero Time |
|---|---|---|---|
| 1,000 | 1,080 | 1 | 1,000 |
| 700 | 756 | 1 | 700 |
| −250 | −270 | 2 | −231 |
| 1,000 | 1,080 | 2 | 926 |
| 700 | 756 | 2 | 648 |
| −250 | −270 | 3 | −214 |
| Totals | 3,132 ✓ | | ✓2,829 |

**Case 2**

| | | | |
|---|---|---|---|
| 1,000 | 561 | 1 | 519 |
| 700 | 756 | 1 | 700 |
| 1,000 | 561 | 2 | 481 |
| 800 | 864 | 2 | 741 |
| −100 | −108 | 3 | −86 |
| Totals | 2,634 ✓ | | ✓2,355 |

Ratio is 1.189

Right ratio = 1.201

# Capitalized Cost vs. Annual Cost

**Prefers Annual Cost Method**

*Sir:*

Without detracting from the validity or fascination of Dr. Jelen's concept of capitalized cost, I would like to point out that the same problems can be attached in a slightly different way.

Dr. Jelen's idea, in effect, appraises all costs in terms of equivalent investment quantities necessary to endow any given expense. The converse can also be used; namely, to translate all investment into annual costs. This method, which I have been using for several years, gives the same answers as Dr. Jelen's and seems a bit more straightforward and less cumbersome.

The analysis is greatly facilitated by the use of five tables generally

available in handbooks and economics texts, such as "Handbook of Chemistry and Physics" and "Mechanical Engineers' Handbook." I shall refer in the following examples to these tables as:

(1) Amount at compound interest
(2) Present value
(3) Amount of annuity
(4) Present value of annuity
(5) Annuity whose present value is 1

Although the procedure is easy enough to dope out from the tables, a few examples selected from Dr. Jelen's articles may be instructive.

1. Refer to Example 2, p. 200, col. 1, Feb. 1954 article, in which Dr. Jelen starts with the cost and life of a new storage tank ($8,000, 12 years) to calculate the maximum which could be spent to patch up an existing tank for a 3-yr. period. Using factors from Table (5) for 4%, 3 and 12 years, we have:

$$(0.1066)\ (8{,}000) = (0.3603)\ x$$
$$x = \$2{,}366$$

2. Refer to Example 1, p. 200, col. 2, Feb. 1954 article, in which Dr. Jelen starts with the cost and life of a piece of equipment ($10,000, 5 years) to calculate the maximum which could be spent annually for painting to extend the life to 10 years. Using factors from Table (5) for 4%, 5 and 10 years, and from Table (4) for 4% and 1 year, we have:

(0.2246) (10,000) = 2,246/yr. over 5 years

(0.1233) (10,000) = 1,233/yr. over 10 years

Difference = 1,013/yr.

(0.9615) (1,013) = $974/yr.

3. Refer to Example 4, p. 185, Aug. 1955 article, in which Dr. Jelen starts with the labor costs for a manual process ($15,000/yr.) to calculate the payout time for automatic controls costing $60,000 and saving a net of $20,000/yr. in reduced labor and improved yield.

A simple calculation of payout time would be 3 years. However, here we are assuming that money is worth 8% per year. The annual return would be 0.333. From Table (5), for $i$ = 0.08, $n$ is between 3 years (0.388) and 4 years (0.302). Interpolation by inspection suggests about 3½ years.

4. Refer to Example 8, p. 187, Aug. 1955 article, which is stated as follows:

"An improperly designed pump has an excessive power cost. Salvage value now is $1,000, decreasing to $250 next year and to $100 the following year. Operating cost for one year more is $700, and $800 for the following year. A replacement costing $3,800 will last 5 years with negligible salvage value. Its operating expense will be uniform at $400 per year. If money is worth 8% should replacement be made now?"

Where more than one year is involved, the calculations are somewhat more complicated, and tabulations (see preceding page) simplify the procedure. In this problem it is convenient to think of the entrepreneur as having no capital of his own, but able to borrow or lend at will at the specified interest rate. A negative amount in the tabulated figures denotes money loaned.

Case 2 is shown to cost the least, the same conclusion reached in Dr. Jelen's article.

Because all five of the reference tables relate to the value of money, there is some freedom of choice as to which particular table to use. Correct interpretation of the values from any of the tables is certain to produce consistent results. For example, Dr. Jelen's capitalized costs can be obtained from Table (1).

Incidentally, when combined with a mortality table, Table (5) can be used to compute the actual return on one's life insurance.

GERARD C. LAMMERS

Chemical Engineer
Wheat Ridge, Colo.

## Prefers Capitalized Cost Method

Sir:

Mr. Lammers' suggestion that replacement problems can be worked out on a yearly cost basis is valid but, in my opinion, the yearly cost method is neither more direct nor simpler. Indeed, it may lead to confusion and errors, such as the common one illustrated in Mr. Lammers' tabulated figures (upper table, preceding page).

It is not permissible to add yearly costs from different years directly, as they do not have the same time base.

For example, suppose we have two plans, requiring the expenditure of money in accordance with different schedules:

Plan I: $10,000 expense first year
1,000 expense second year
Plan II: $ 1,000 expense first year
10,000 expense second year

Both plans require $11,000 for the two years, but Plan II is the cheaper because it delays the period when the bulk of the money must be put up. Before adding yearly expenses they must be brought to a common time basis. In capitalized cost we use zero time as the base.

In analyzing the pump example by Mr. Lammers' yearly cost method, I have shown the correct solution in the second table. The ratio of yearly costs for Case 1 and Case 2 by Mr. Lammers' method would be

$$3{,}132/2{,}634 = 1.189$$

The ratio of capitalized costs given in the original example was

$$19{,}825/16{,}509 = 1{,}201$$

Both cannot be right. When Mr. Lammers' figures are corrected to zero time the ratio is

$$2{,}829/2{,}335 = 1.201$$

which checks the capitalized cost method exactly. Mr. Lammers' error in this example is relatively small because only a short time is involved and the yearly costs are fairly close together.

As mentioned in the articles, the yearly cost method can easily be used simply by multiplying the capitalized cost by the interest rate.

F. C. JELEN

Allied Chemical & Dye Corp.
Syracuse, N. Y.

►*Other recent correspondence concerning Dr. Jelen's articles dealing with the concept and application of capitalized costs (Feb. 1954, pp. 199-203, and Aug. 1955, pp. 181-189) will be found in the Pro & Con department in this issue on p. 350. Earlier correspondence appeared in Pro & Con in Apr. 1954 (pp. 378-380); June 1954 (pp. 407-410); Aug. 1954 (pp. 329-331).*

*Watch for publication soon of a third article by Dr. Jelen presenting a completely new concept in the application of capitalized costs—the solution of problems in engineering economics where inflationary factors are involved.*—ED.

# Pneumatic Relays for Process Control

## How to Design Circuits
## How to Use Them

**At the Terre Haute plant of Commercial Solvents Corp. is an installation for pneumatic relaying and sequencing which is one of the finest examples of this kind of automatic control in existence. This is the company's automatic fermentation unit for penicillin. Here the author used more than 1,000 pneumatic relays to relieve the operators of practically all detail in running the plant and making it possible to start and stop nearly every operation simply by pushing a button. As many as 40 to 50 valves may be controlled and sequenced for each such operation. This article describes how pneumatic circuits of this type can most easily be designed.**

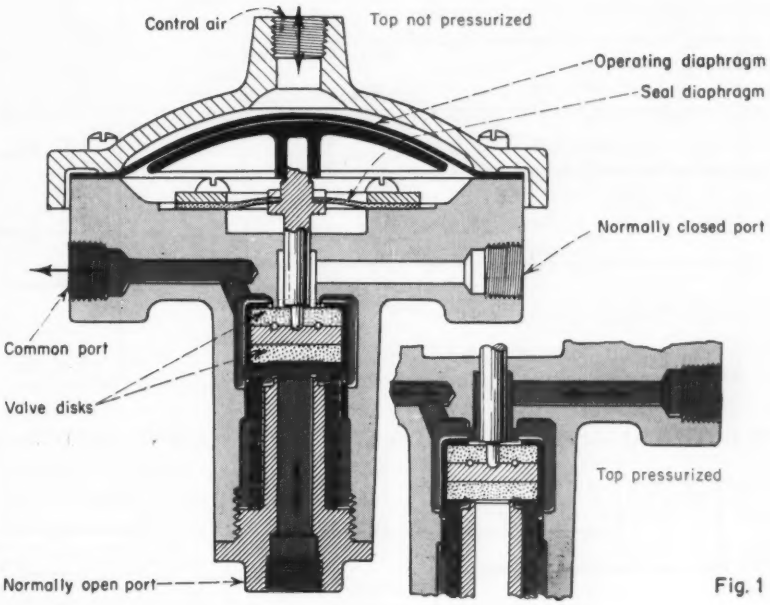



Fig. 1

**ROBERT D. COWHERD, Commercial Solvents Corp., Terre Haute, Ind.**

COMPRESSED air is a familiar energy source for powering automatic controls in process industries. It is much less familiar, however, in its use in pneumatic relaying circuits. Perhaps one reason why such circuits have not been used more widely is the lack of a simple method of design. Our purpose here is to provide such a design method, and also to examine some of the uses of pneumatic relay circuits.

Most instrument-minded engineers are familiar with electrical relays and with at least some of their applications in controlling and sequencing various sorts of operations. However, several characteristics of pneumatic control for process industry uses make it worthwhile to learn how similar jobs can be handled by pneumatic relays. Pneumatic control equipment is inherently explosion-proof; it can store its own operating energy for an appreciable period after a power outage and thus retain the settings that were in force before power was lost; and its maintenance is generally more familiar to process plant personnel than that of electrical control.

It is true that electrical controls can be made explosion-resistant with proper design, installation and maintenance. But even a momentary power outage will drop out locked-in relays, often with hazard to personnel and equipment. Against that is the ability of pneumatic relaying systems to store energy long enough so that auxiliary power sources can be brought in without difficulty. One such installation with over 1,000 pneumatic relays retained its control relationships for 25 min. on one occasion, without changing a single relay air valve.

Electrical relays are much faster than pneumatic, but the need for very rapid response is the exception rather than the rule. If air circuit time is excessive, electrical components can easily be substituted. Designing for minimum volume and air-flow resistance will generally yield pneumatic circuits with time constants that are adequately low.

Also, it can be argued that electric circuitry costs less than pneumatic. This is mainly because two or more independent circuits can be actuated mechanically by a single relay coil, while in a pilot (or relay) air valve only one circuit can be directed through either of two paths. However, when explosion resistance is essential, costs become comparable, while the advent of polyethylene instrument tubing has tended to put installation costs of the two methods on an equal footing.

This is not to imply that pneumatic relays will in general replace electrical relaying circuits, since each type will have its place. But it does mean that pneumatic relaying will become more prevalent in process industries than it has been in the past, in applications where its particular advantages are important.

In recent years engineers have become increasingly familiar with the practice of using processes in one energy system as analogs to help explain

## A Simple Electrical Circuit and Its Pneumatic Analog

**ELECTRICAL—Ladder Diagram**

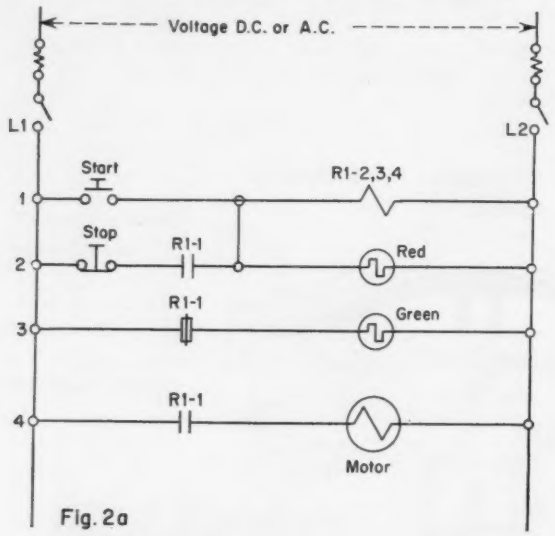



Fig. 2a

**PNEUMATIC—Branch Diagram**

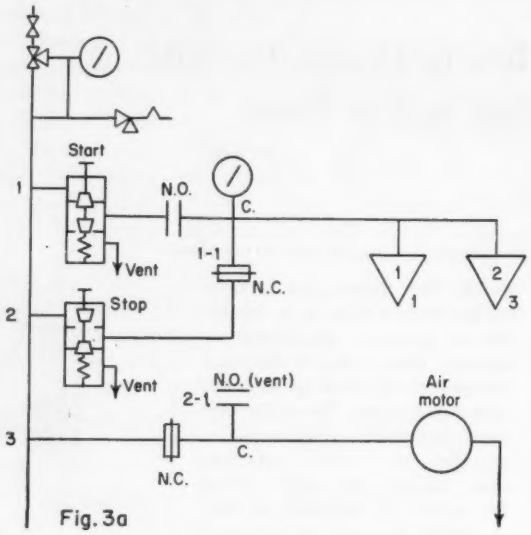



Fig. 3a

**ELECTRICAL—Schematic Diagram**

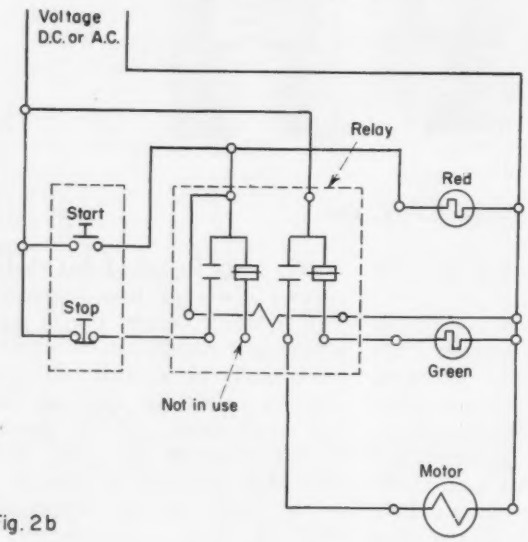



Fig. 2b

**PNEUMATIC—Schematic Diagram**

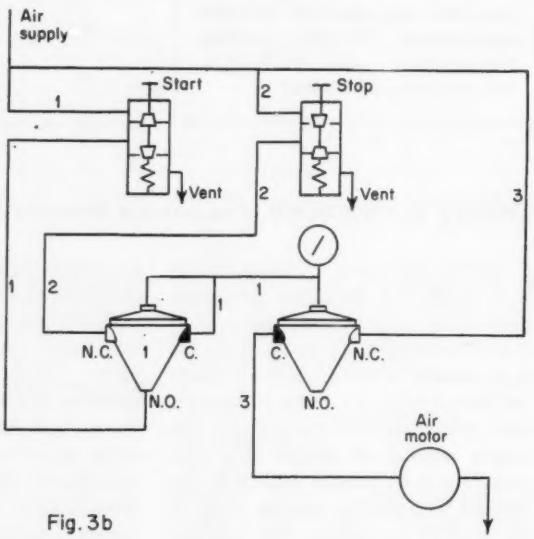



Fig. 3b

other energy systems. Thus pneumatic and hydraulic analogs are often used to explain electrical systems. Here, however, is a case where the reverse is helpful because an available "shorthand" system of notation in electrical circuit design can be transferred almost bodily into the field of pneumatic circuitry.

After we have seen how this system works with a simple electrical relay circuit, we can translate it almost intact into the design for an equivalent pneumatic circuit.

### Electrical—the Ladder Diagram

In essence, an electrical relaying circuit consists of a combination of switches and relays, the latter operating contacts which control end loads such as motors, solenoid valves, heaters, and the like, in some predesigned sequence. The "ladder" diagram shown in Fig. 2a can be used more easily in designing and portraying such a hook-up than the point-to-point schematic shown in Fig. 2b.

Our first problem is to grasp the idea of the "ladder" diagram. Here the central simplifying concept is that we may divorce the actuating coil of a relay from its contacts. This would be completely untenable in an actual relay, of course, since the contacts must be mechanically attached to the coil. But in a "ladder" diagram (Fig. 2a), a relay coil may be shown in one rung of the ladder, while its contacts are scattered in the same or other rungs as the designer wishes. The only restriction is that the coil and its contacts must be labeled and cross-refer-

## Electrical Symbols and Their Pneumatic Analogs

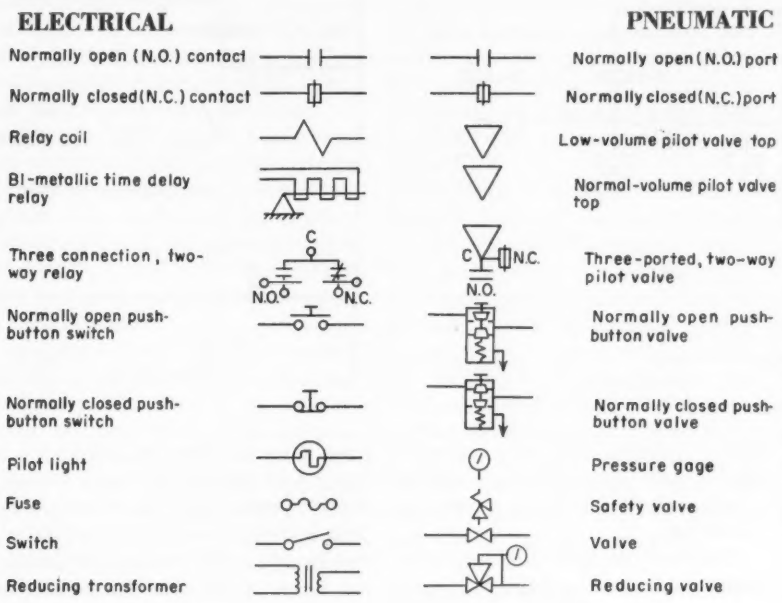



Fig. 4

enced so that they will be known to be associated, even though they are shown separated.

In discussing relays, we customarily use the terms "normally open" and "normally closed." In drawing relay diagrams it is the convention that the contacts are shown in normal condition when the circuit has zero power supply. Therefore, any contact on the diagram will be in the reverse position from that shown when its relay coil is energized.

Obviously, the complete operation of every component of the circuit must be thoroughly understood before its contribution to the required sequence can be properly evaluated. However, no great skill or knowledge of electrical engineering is needed in using the short-hand of the ladder diagram to secure extremely interesting results.

### A Simple Design

Suppose we want to set up a circuit which will energize a single-phase motor and light a red light when we momentarily press a pushbutton. A second momentary pushbutton will be provided to stop the motor, de-energize the red light, and light a green light to indicate this condition.

In drawing our ladder diagram the first step is to draw the power supply lines as uprights L1 and L2 in Fig. 2a. Another convention is to draw all switches and contacts on the left side of the diagram, and all load components on the right. Still another is the system of cross references. Fig. 2a shows how the relay coil and its contacts are identified. In rung 1, coil R1 is shown to be associated with contacts in rungs 2, 3 and 4, while the contacts in rungs 2, 3 and 4 are all marked R1-1, indicating that they are operated by coil R1 in rung 1.

Fig. 2a shows a circuit which will fulfill all of the conditions we have stipulated for the motor starter. How does it operate? Pushing the "start" button momentarily energizes the circuit containing the relay coil R1 and the red pilot light. This closes the normally open contact in rung 2, thus bypassing the pushbutton so that removing the applied pressure does not de-energize the coil. This type of circuit is commonly called a "lock-up" and contact R1-1 in rung 2 is called a "lock-up" contact. At the same time, contact R1-1 in rung 3 opens, so that the green pilot light is de-energized. Also in the same instant, contact R1-1 in rung 4 is closed and the motor starts operating.

To stop the motor we press the "stop" button so that the "lock-up" in rungs 1 and 2 is opened and relay coil R1 in rung 1 is de-energized. This de-energizes the red pilot light and opens the relay contact R1-1 in rung 2. Removing the applied pressure on the "stop" button closes its contact, but both the "lock-up" contact and "start" button are open so that no re-energizing of the relay coil R1 can occur. Since the coil is now de-energized, the normally closed contact R1-1 in rung 3 will re-energize the green pilot light, while the normally open contact in rung 4 will open and stop the motor.

It takes only a casual comparison of Figs. 2a and 2b to show the relative simplicity of the ladder diagram, compared with the identical circuit portrayed by the point-to-point schematic in Fig. 2b. The difference is even more apparent in relaying circuits of greater complexity.

### Pneumatic—the Branch Diagram

We have noted how an electrical and a pneumatic system can each be used as the analog of the other. Let us see how some pneumatic components can be considered analogous to a number of electrical relaying components. Fig. 4 lists a number of these analogs. One of the most basic elements in this array is the relay coil

R. D. COWHERD, instrument engineer in the Engineering Department of Commercial Solvents Corp., Terre Haute, Ind., since 1946, was born in Kentucky 44 years ago. He obtained his ChE degree at University of Cincinnati in 1935 and before joining Commercial Solvents was an application engineer with The Bristol Co., in Waterbury, Conn. A member of ISA and AIChE, his hobby is proving that pneumatic relay circuits can outperform their electrical counterparts.

The present paper is based on one the author presented before the Second Annual Instrumentation Conference at Louisiana Polytechnic Institute.

**Deferred Action Circuit**

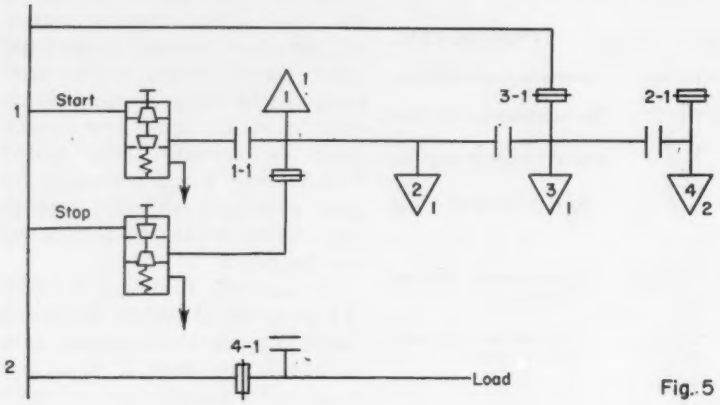



Fig. 5

**Pneumatic Oscillator**
**(Regenerative Circuit)**

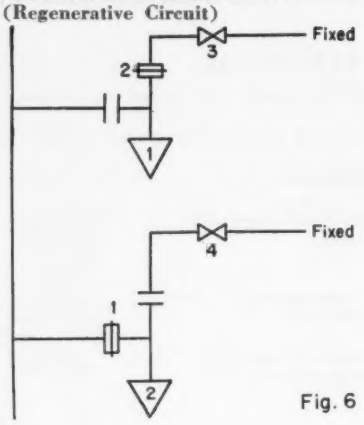



Fig. 6

and its associated contacts. The coil converts electrical energy into a magnetic pull or force which then operates the contacts by means of a mechanical linkage. Comparable to this is the air-operated pilot or relay valve which is almost a complete analog. Fig. 1, a valve made by Johnson Service Corp., may be taken as typical. The diaphragm actuator transforms pneumatic energy into mechanical motion which operates the ports of the valve body. These ports are comparable to the contacts of a relay in that one permits and other denies passage to a fluid, just as the relay contacts permit or deny passage to an electrical current.

The principal difference between the electrical relay and the pneumatic pilot valve lies in the time to operate. There is an inevitable lag in the valve due to the volume of the equipment and the resistance to air flow of the connecting tubing and fittings. Therefore a closer electrical analogy would be the heater type relay with a built-in time delay. In such a relay the coil and its magnetic circuit are replaced by a heater element and a bi-metal strip on which is a common contact. Comparable to the flow resistance characteristic of the pilot valve is the resistance to heat flow between the heater and the bi-metal strip. Comparable to the volume delay in the pilot valve is the physical bulk and capacity of the bi-metal element.

In Fig. 4 it will be noticed that the symbols for both normally open and normally closed ports exactly duplicate the older electrical notation. The grouping of two types of ports to form a three-ported, two-way valve is completely analogous to a relay coil with one normally open and one normally closed contact, each having a common connection.

There are two major differences between the electrical and the pneumatic systems. A normally closed electrical contact allows energy to flow in the circuit, while a normally closed port does not. Furthermore, a pneumatic circuit stores energy and to de-energize it requires not only closing off the supply pressure, but bleeding off the trapped downstream pressure. It is clear that the three-ported, two-way valve can replace either a normally closed or a normally open electrical contact, but not both with the same pilot.

## Applying the Analogy

With little change the idea of the two-wire ladder diagram may be converted to what we shall call a "branch" diagram for pneumatic circuits. Here we need only a single air header. In transferring electrical energy, the hot side of the line comes from the generator and the ground wire returns to it, completing the electrical loop. In a pneumatic system, however, a single piece of tubing brings pneumatic energy from the compressor, while the atmosphere constitutes the return. Various branches emanate from the header on the "branch" diagram to include ports and relays as needed.

As in the ladder diagram, there is no need for a pilot valve top or actuator to be associated with its ports as long as the two components are cross-referenced to their respective branches, exactly as explained for the ladder diagram. Thus the same simplifying concept can be used for pneumatic circuit design. Furthermore, the branch diagram is always shown for zero air pressure in the circuit, just as the ladder was shown in its de-energized condition. Thus, when a pilot top is pressurized, the ports reverse themselves from the position shown in the drawing.

Now we are ready to design a pneumatic circuit that will duplicate the actions in the motor starter circuit of Figs. 2*a* and 2*b*. In this case we want to start a small air motor or turbine by actuating a momentary pneumatic pushbutton valve, using a pressure gage to indicate the fact. Another momentary pneumatic pushbutton valve will be actuated to stop the motor and drop the gage pressure to zero, indicating that the motor is not operating.

In Fig. 3*a* we have a pneumatic circuit diagram comparable to the electrical circuit diagram in Fig. 2*a*. When the "start" button is momentarily depressed, air flows into branch 1 through the normally open port of pilot valve 1 and its common port, reaching the diaphragm tops of pilot valves 1 and 2. As soon as pilot top 1 is pressurized, it reverses its ports so that the normally open port of pilot valve 1 is closed to the initial impulse and the normally closed port is opened to an auxiliary air supply by way of the normally open port of the "stop" button. The circuit is now locked up pneumatically in the same manner as the electrical circuit.

At the same time, pilot valve 2 is pressurized, along with the pressure gage which indicates this fact. The ports of pilot valve 2 reverse their po-

sition so that the normally closed port in branch 3 is opened and the normally opened vent port is closed. Thus air is supplied to the air motor. When we want to de-energize the motor, we depress the "stop" button, thus closing its normally opened port and opening its normally closed port to the atmosphere. This eliminates the auxiliary air supply and allows pressure trapped in branch 1 to bleed down through the now open, normally closed port of pilot 1 in branch 1.

As soon as the branch 1 pressure has been reduced below that necessary to hold in pilot valve 1, its ports reverse, reverting to their normal position, and allowing the remaining pressure to vent through the normally open port of the "start" button. Thus the pressure on pilot valve 2 and the pressure gage go to zero and the ports of pilot valve 2 in branch 3 revert to their normal position, cutting air off the motor and stopping its motion.

Fig. 3*b* is a schematic diagram illustrating how the pneumatic motor starter is actually tubed. As in the comparable electrical diagram (Fig. 2*b*), the schematic definitely limits the ability to visualize the sequential relationships of the components. The pneumatic point-to-point diagram follows from the branch diagram, rather than vice versa.

However, a schematic diagram is useful in determining the relative positions of the pneumatic components in order to eliminate excessive tubing runs. Minimizing tubing is important not only from a cost standpoint, but also in minimizing the resistance to flow and the volumetric capacity of the lines so as to hold down the time constant and prevent sluggish response.

Sometimes it is necessary to combine electrical and pneumatic circuits for the same control problem. Typical cases are those where pump motors are to be sequenced, or pneumatic circuits are to be actuated by electrical sensing elements. Such combinations are simple. Transfer from a pneumatic to an electrical circuit requires a pressure switch. Returning to pneumatic from an electrical circuit makes use of a solenoid-operated air valve. These two simple components permit a versatility that is not often encounteerd.

## Pneumatic Circuit Characteristics

The speed of operation of a pneumatic circuit depends on: (1) the circuit volume; (2) its resistance; (3) the system supply pressure; and (4) the pressure necessary to operate the pilot valve. We can see how these factors affect the speed by studying the expression for a single-capacity pneumatic system:

$$p = p_s(1 - e^{-t/RC})$$

which shows how pressure will rise in a closed chamber when it is suddenly connected to an air supply through a restriction. Here, we can consider that $p$ is the pressure, in psig., that will be reached on the diaphragm top of a pneumatic relay after time $t$, in sec. Term $p_s$ is the supply pressure, in psig., $R$ is the lumped resistance to air flow into the diaphragm top, in psi./(cu. in./min.), and $C$ is the capacity of the connecting piping, plus the diaphragm top, in cu. in./psi. Term $e$ is the base of the natural logarithm system, 2.71828.

The factor $RC$ is termed the time constant of the system, and has the units of time. When $RC = t$, then from the equation, $p = 0.632\ p_s$, and this value of $RC$ is called the lag coefficient. For example, if we design our single-capacity system to have a lag coefficient of 1 sec., then at the end of 1 sec. the chamber pressure will be 0.632 $p_s$.

In designing a pneumatic circuit we ordinarily want to minimize actuation time, which means we must minimize the lag coefficient. Any way to reduce the capacity—and hence the energy storage—of the system, and any way to decrease the flow resistance, will work toward a smaller lag coefficient. For example, the valve shown in Fig. 1 has the very small diaphragm casing volume of 0.8 cu. in. when under pressure. Using connecting tubing of $\frac{3}{16}$ or $\frac{1}{4}$ in. O.D. has been found to give adequate low resistance in extensive relaying circuits when using a 25 psig. air supply.

We can get an idea of the effect of supply pressure on valve actuation

**Volumetric Flowmeter and Its Branch Diagram**

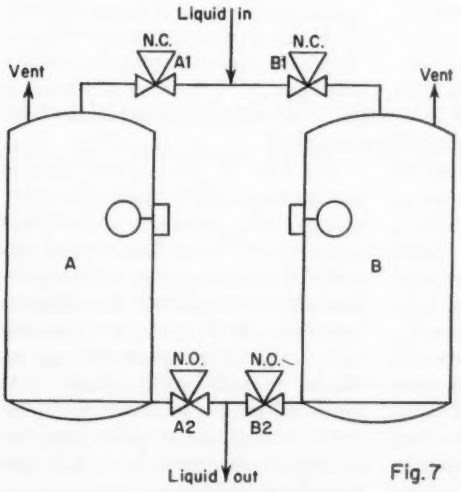
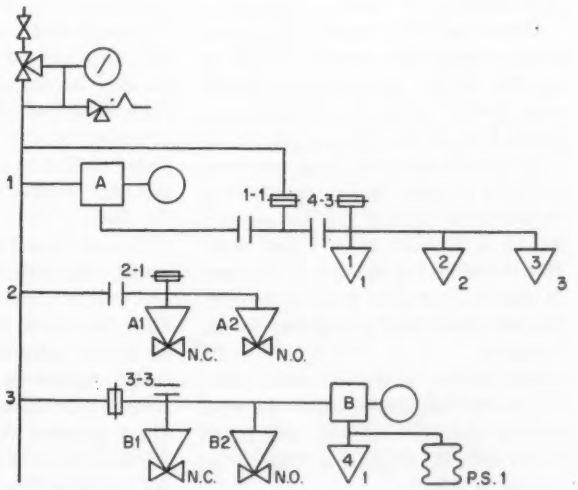



Fig. 7



time by plotting the pressure-time curves for a system of known lag coefficient for each of several supply pressures. If the lag coefficient is 1 sec. and the actuation pressure is 4 psig. (as with Fig. 1), then a 10 psig. supply will give about one-third the actuation time of a 5 psig. supply. Doubling the actuation pressure will require doubling the supply pressure for the same time. Thus we see that low pilot valve actuation pressure permits both a lower supply pressure and a minimum actuation time.

### Deferred Action Circuits

The purpose of the hook-ups shown in Figs. 2a and 3a was to start or stop a process at will. Sometimes our object will be to energize another load when the "stop" button terminates the initial lock-up. This is termed a "deferred action" circuit. A typical example is shown in the branch diagram of Fig. 5.

When branch 1 in Fig. 5 is pressurized momentarily with the "start" button, a lock-up occurs due to pilot valve 1. The valve reverses its ports in branch 1, bringing in the auxiliary air supply through the "stop" button. In so doing, pilot valve 2 is energized, along with pilot valve 3. Pilot valve 2 immediately reverses its ports, closing off the branch supply and venting the top of load pilot valve 4. Pilot valve 3 reverses its ports, causing a lock-up action to occur which closes off the branch circuit, but brings in an auxiliary supply up to, but not through the now closed, normally open port of pilot valve 2.

When the "stop" button is momentarily actuated, the complete branch to the left of the now closed, normally open port of pilot valve 3 is de-energized. During this process pilot valve 2 is also de-energized, thus returning its ports to their normal position as shown, and making the air pressure locked in by pilot valve 3 now available to the load pilot valve 4. Its ports in branch 2 are thus reversed, to energize whatever load is required in the sequence.

By placing additional load pilots in parallel with pilot valve 2, other circuits may be initiated and terminated with the original lock-up circuit shown in Fig. 3a.

### Regenerative Circuits

Fig. 6 shows an interesting pneumatic circuit which can be used to cause a regenerative or oscillating action between two pilot valves. Need for a life-testing device for the components was responsible for its design originally. When air is first admitted to the circuit the top of pilot valve 1 is pressurized through the normally open port of pilot valve 2. When pilot valve 1 is energized its ports reverse themselves, thus admitting air pressure to the top of pilot valve 2. Pilot valve 2 reverses its ports, but pilot valve 1 does not immediately lose its pressure owing to the resistance-capacity time constant which is fixed by the volume of the circuit and restriction 3. As soon as the air pressure has dropped to a point below the actuating pressure of pilot valve 1, it again reverses its ports. For the same reason, pilot valve 2 does not immediately lose its pressure. When it does, its ports return to the position shown and pilot valve 1 is again re-energized. Thus the cycle continues. By adjusting the restrictions—which are usually needle valves—large variations in frequency may be obtained.

Another regenerative type sequence circuit, this time applied to a volumetric flowmeter, appears in Fig. 7. Here two tanks are alternately filled and emptied with liquid to a level determined by a float-type detecting mechanism.

Tanks A and B have normally closed valves A1 and B1 in the inlet lines, and normally open valves A2 and B2 in their outlets. Both tanks are vented. To insure that one will empty before the other has filled, the outlet valves are sized larger than those on the inlet. Each tank has a float-operated level-detecting relay of the on-off type, adjusted so that an increase in output air pressure results when liquid rises to the float.

To see how this flowmeter circuit works, assume that the tank B is empty and tank A is either empty or partially filled, but not to float level. When the air supply valve in the pneumatic circuit is turned on, the normally open port of pilot valve 2 in branch 2 introduces pressure to the process valves A1 and A2, closing A2 and opening A1 to allow liquid to enter tank A. Since branch 3 is vented to the atmosphere, valves B1 and B2 are in their normal positions.

When the liquid level reaches the float relay in tank A, branch 1 is instantly pressurized and locked up by the reversal of ports of pilot valve 1 in branch 1. Simultaneously, pilot valves 2 and 3 are also pressurized. Thus the ports of pilot valve 2 in branch 2 close off the air supply and vent the existing pressure to the atmosphere, allowing valve A1 to close and A2 to open, and emptying tank A of its contents to storage or processing facilities. The ports of pilot valve 3 in branch 3 reverse their positions also, putting header supply pressure on the process valves B1 and B2, as well as on the level detector relay in tank B. Liquid now starts flowing into tank B, with valve B2 closed. When the level reaches the level detector, pilot valve 4 in branch 3 is energized, thus dropping the branch 1 pressure to zero. The level detector in tank A is, of course, at zero pressure at this point and branch 1 will remain de-pressurized.

When branch 1 drops to zero pressure, pilot valve 3 returns to normal and in so doing vents the branch 3 pressure to zero. Hence process valve B1 closes off the supply to tank B, while B2 empties it. Returning pilot valve 2 to the normal condition repressurizes branch 2 through its normally open port, thus opening process valve A1 and closing A2. Hence tank A again starts to fill and the process continues regeneratively as long as air is supplied to the control circuit and liquid to the tank. A pressure switch P.S. 1 can be installed in parallel with pilot valve 4, its impulses actuating an electrically operated integrator with a multiplier of 2 to keep a record of the number of times the tanks have been filled.

The idea of using some physical measurement of the process to regenerate a cyclic process, or to initiate a sequence, can be used widely and successfully in converting batch operations to some semblance of continuous operation. With such an approach many unprofitable processes can be thrown into the profit column. As processes become more and more automatic in the future, it is likely that the techniques discussed here will find widespread usefulness.

# How to Find Best Site for New Plant

**Technique described here permits optimum solution in minimum time. Management decision can be made with high confidence.**

**D. V. BIERWERT & F. A. KRONE, Monsanto Chemical Co.**

STEPS:
1. Over-all analysis of problem.
2. Potential location cases.
3. Analysis of tangible factors.
4. Analysis of intangible factors.
5. Presentation to management.
6. Management decision.

EXPANDING chemical markets mean increased sales and production. As a result, many managements today are faced with the problem of finding an optimum location for additional plant facilities.

Solution of this problem is often lengthy. It is usually complicated by involved economic relationships, uncertain estimates, and intangible factors which evade accurate definition. The problem, therefore, becomes one of providing management with the "best basis possible" for the development of its final decision in the selection of a new plant location.

Purpose of this article is to describe and illustrate how this "best basis possible" can be developed.

For the purposes of illustration let us assume that a company has a product in the rapid-growth stage. The sales department demands more production, and the present plant is already at full-capacity operation. The time has arrived to determine where to locate additional production facilities.

## Over-All Analysis of Problem Characteristics

A clear understanding of all characteristics of the problem is vital before any simple or involved study is undertaken. This means that a general study must be made to determine the overall nature of the problem. Alternative processes, product characteristics, market locations, minimum-maximum sales ranges, preliminary cost and capital data, plus other similar factors should be studied and developed to provide a definite scope for the problem.

Consultation with the engineering, sales, production, research, traffic and purchasing departments and possibly with outside consultants is both desirable and essential at this stage. This consultation activity, while particularly important in the initial stages of problem solution, should be carried on as required throughout the solution.

Exact approach required will be prescribed by the size and scope of the problem since each problem is unique. However, the fundamental principles remain essentially unchanged.

The problem should be clearly defined as to objectives and scope—including any management policy restrictions—as soon as the basic background information is developed. Project requirements should then be set up to narrow the evaluation.

Fortunately, most problems are characterized by a few vital requirements. For example, a process requiring a gaseous byproduct of a refinery needs to be located near a refinery or other source of economical transportation such as a pipeline.

## Development of Potential Location Cases

### Make Up Preliminary List of Potential Locations

At this point a list of locations which satisfy the project requirements should be made.

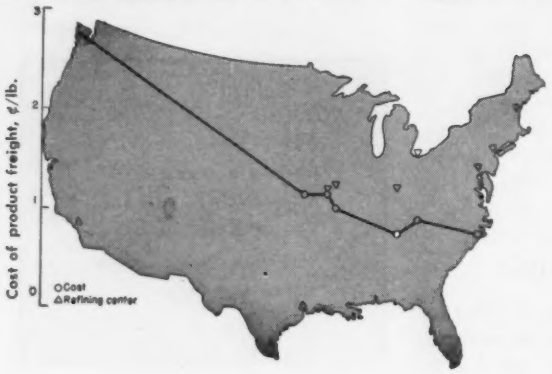
Reference to the different trade, financial and technical publications will aid in the search for attractive potential locations.

In the particular case of oil refining byproducts, a helpful list of all refineries along with capacities and locations is published periodically in the petroleum journals. U. S. Government Agency publications are also helpful in locating areas with tailor-made characteristics such as excess labor supply, heavy power generation, etc.

By calculating the preliminary economics for the various locations to be considered, it is possible to select the most attractive cases. It is important, when screening is complete, to present the results to the decision-making executive in such a form that concurrence or revision is possible. This is a key phase of the solution since collaboration with such an executive will serve to keep the solution "on the right track" and reduce or obviate work in evaluating cases of minimum interest.

To clarify the above, an example from actual experience follows on the next page. Some revisions have been made to protect private process "know-how."

**Average Product Freight Costs**




**Potential Plant Locations**

| Location | Refining Capacity, MM Bbl./Day | | Remarks |
|---|---|---|---|
| | Crude | Cat. Cracking | |
| A | 162 | 60 | |
| B | 232 | 88 | * |
| C | 394 | 148 | |
| D | 100 | 30 | |
| E | 140 | 85 | |
| F | 60 | 30 | |
| G | 58 | 22 | * |
| H | 50 | 20 | * |

* Near present company-owned sites.

**Example:**

Preliminary project studies indicated the following requirements:

1. It was advisable to locate the project near a refinery since the raw material source was a petroleum fraction. Also the large volume of process byproducts involved could best be utilized in refinery products.
2. Process raw material analysis showed that a minimum of 30 million lb. per year would be required.
3. Product freight, power and labor were major cost items.
4. A split process would permit production of an intermediate at one site and finished product at another.

Raw material requirements were correlated with refinery size and percent cracking. Results indicated the minimum size refinery to be considered would be one with 50,000 bbl./day charge and having a catalytic cracking capacity of at least 30% of the crude running capacity.

Plotting average freight cost for a plant location at various known refining centers (see map) further narrowed the choice to the eastern half of the U. S.

At this point in the study, a simplified overall relationship of important project factors to location was developed. By application of various mathamatical techniques and trial and error, an optimum location was derived—which unfortunately was nowhere near a refinery.

After some research in the petroleum refining literature, eight prospective locations appeared to fit project requirements, as shown in the table.

Project requirements, the map, and the table along with other data formed the basis for executive concurrence with recommendations to further study the locations A, B, C, D, E, F, G, and H.

## Reduce Number of Potential Location Choices by Site Surveys

Further reduction in the list of potential locations is possible by finding and surveying possible plant sites. A survey team consisting of a seasoned construction engineer, transportation manager, and a representative of the evaluation team should be appointed to do the job.

Study of the several published site evaluation check lists will be helpful. Important items to check are acreage available, cost of acquiring and developing the land, availability of utilities, labor market and transportation facilities. If a location is dependent on a local raw material supplier, negotiations should be undertaken to determine raw material prices.

At the conclusion of the survey, results should be consolidated and presented for executive review. Usually, at this point, the number of choices can be reduced considerably. This again is best illustrated by example.

**Example:**

Continuing from the previous example where there were eight potential locations, a survey was made of the available sites to determine their good and bad features. Preliminary negotiations with raw material suppliers resulted in preliminary price quotations.

Results of the survey are shown in the table at the top of the following page.

All but two locations were eliminated on the basis of low or no volume of available raw material, lack of land, or high raw material price. Location C, at an existing company-owned site, and location E were recommended for further consideration by the survey team consisting of the above-mentioned personnel.

Location E was chosen despite difference in site development costs, since this difference was approximately offset by the difference in product freight costs. Executive review resulted in acceptance of the recommendation.

### Results of Site Survey

| Location | Raw Material: Volume MM Lb./Yr. | Raw Material: Price Range $/Lb. | Plot No. | Acreage | Relative Cost to Acquire & Develop | Transportation: Rail | Transportation: Water | Transportation: Truck | Utilities Available: Steam | Utilities Available: Water | Utilities Available: Power |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 10 | Company has internal demand | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| B | Supplier only willing to supply at location C | | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| C* | 60 | 6–7 | Will accommodate project | | 8 | X | X | X | New facilities needed | | |
| D | 20 | 7–8 | 1 | 20 | 11 | ... | ... | ... | ... | X | X |
| | | | 2 | 300 | 19 | X | X | X | ... | X | X |
| E | 60 | 6–7 | 1 | 50 | 9 | ... | ... | ... | X | X | X |
| | | | 2 | 300 | 19 | X | X | X | ... | X | X |
| F | 10 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| G* | 15 | 7–8 | None available | | ... | .. | ... | ... | ... | ... | ... |
| H* | 15 | 7–8 | Will accommodate project | | 8 | X | ... | X | New facilities needed | | |

* Company owned site.

### Set Up a Series of Case Studies to Evaluate Alternatives

At this point, the novice is misled into believing that the problem is straightforward and simply involves the net advantage for each of a series of cases; such as the following:

Case I .....Location A
Case II .....Location B
Case III .....Location C

However, consultation with the decision maker and careful study of the project will usually reveal a large number of uncertainties. By incorporating a means for their evaluation and executive appraisal in the basic study, numerous calculations at a later date can be avoided.

A good knowledge of the statistical approach to the design of experiments is helpful since the evaluator is essentially designing a set of factorial calculations.

Typical uncertainties are:

*Plant Capacity*—Since sales volume cannot be predicted accurately, selection of plant size involves a gamble. Also, the capacity utilization may have a marked effect on the relative attractiveness of several locations under consideration.

*Yield or Conversion*—Depending on the newness of the process, quality control of the feed stock and other factors, yield and conversion may be somewhat uncertain. Yield and conversion may have different effects on costs at various locations, possibly due to differences in demand for by-products or spent reaction products.

*Capital and Manufacturing Costs*—The approach for handling the evaluation of this uncertainty is covered under evaluation of tangible factors.

*Research and Overhead Expense*—Location of a project at a new site may result in overheads which are not in line with company experience.

The properly studied approach may be illustrated by the example.

### Example:

Last status of the project used in previous examples was that two locations appeared attractive.

A third alternative was developed in which an intermediate could be made at one company-owned location adjacent to a raw material supplier and the finished product at another company-owned location near the market center. Due to other expansion commitments at both sites, however, this third alternative did not necessarily rule out the new site.

Uncertainties were revealed:

*Plant Capacity*—Both yield and processing cycle were uncertain, due to changes in the process.

*Sales Volume*—About 30% of the potential sales could be arranged on a long-term contract basis. Remaining sales would go into a new field with which the company was unfamiliar.

*Sales Expense*—Since a new type of marketing technique was involved, sales expense was not expected to conform to the over-all company average experience.

Cases were set up as at the left.

| Variable | Case I | Case II | Case III |
|---|---|---|---|
| Location | C (Company-owned) | E (New site) | C & I (Process split between 2 company sites) |
| Cycle time | | | |
| 150 hr. | X | X | X |
| 100 hr. | X | X | X |
| Sales volume | | | |
| 10 MM | X | X | X |
| 20 MM | X | X | X |
| 30 MM | X | X | X |
| Sales expense | | | |
| 4% net sales | X | X | X |
| 8% net sales | X | X | X |
| Yield | | | |
| 90% | X | X | X |
| 60% | X | X | X |

# Evaluation of Tangible Factors

The previous step resulted in the assembly of a series of cases for further study which took into account the evaluation of major known project uncertainties. This step consists of the estimation of the tangible gains or losses which will accrue to the company upon completion of the project.

## Decide What is Needed

First step in the evaluation of tangibles requires a definite fixed formula for over-all evaluation. In some companies, this is rate of return. In others, it may be pay-off time, or some similar approach based on the time value of money (compound interest).

If such an evaluation formula is not available, then the decision-making executive must establish one, to insure uniform consideration of all cases. A standard type capital estimation form, cost form, and rate of return or project value form are vital for intelligent evaluation of the alternative cases.

The staff group should be assigned to the development of an evaluation check list. The check list is a summary of information needed. It will insure complete data with a minimum of effort.

## Conduct a General Survey to Get the Data

A key point in the development of a solution to the problem has now been reached. Quantity, price, and/or cost must be determined for each item on the check list. The responsibility would be carried by the staff group.

While major uncertainties have been accounted for in the case study structure, a review of previously completed projects will indicate capital over-runs, under-estimated costs, and other factors which add to the risk aspect of any project. Consequently, where the values of quantity, price, or cost are definitely known for a check list item, only one value will be required. Where an element of uncertainty exists, values at minimum, best-guess, and maximum levels should be determined.

A great deal of travel and communication with outside agencies will be required to accumulate the necessary data where a new site is involved. Study of the several good recent publications on where to get this type of information, plus consultation with existing customers and potential suppliers in the site area, will provide the leads necessary for a top-notch survey.

## Develop Each Case on the Basis of the Best Guesses and Calculate Possible Deviations for Each

When case study calculations are complete, a major decision will be in order. Consequently, a great deal of thought and planning must be devoted to the presentation of results to the decision maker. A combined tabular and nomographic approach will permit maximum executive exploration of the problem. If the presentation is properly designed, the number of additional cases to be calculated will be minimized.

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The calculations which form the heart of the study should be based on the best-guess values. When these calculations are complete, a review should be made of the ultimate effects of maximum and minimum levels of any uncertain variables which have not been covered in the case study structure. It is possible to segregate the items which can have a significant effect on the best-guess calculations. When this is complete, an evaluation should be made to show the effect of these items, singly and collectively, in the best-guess presentation.

Presentation of results at this stage, in proper form, will usually lead to a semi-final decision. While the proper form is limited only by the imagination of the evaluator and the special requirements for the decision maker, the following example may furnish a clue to the many possibilities involved.

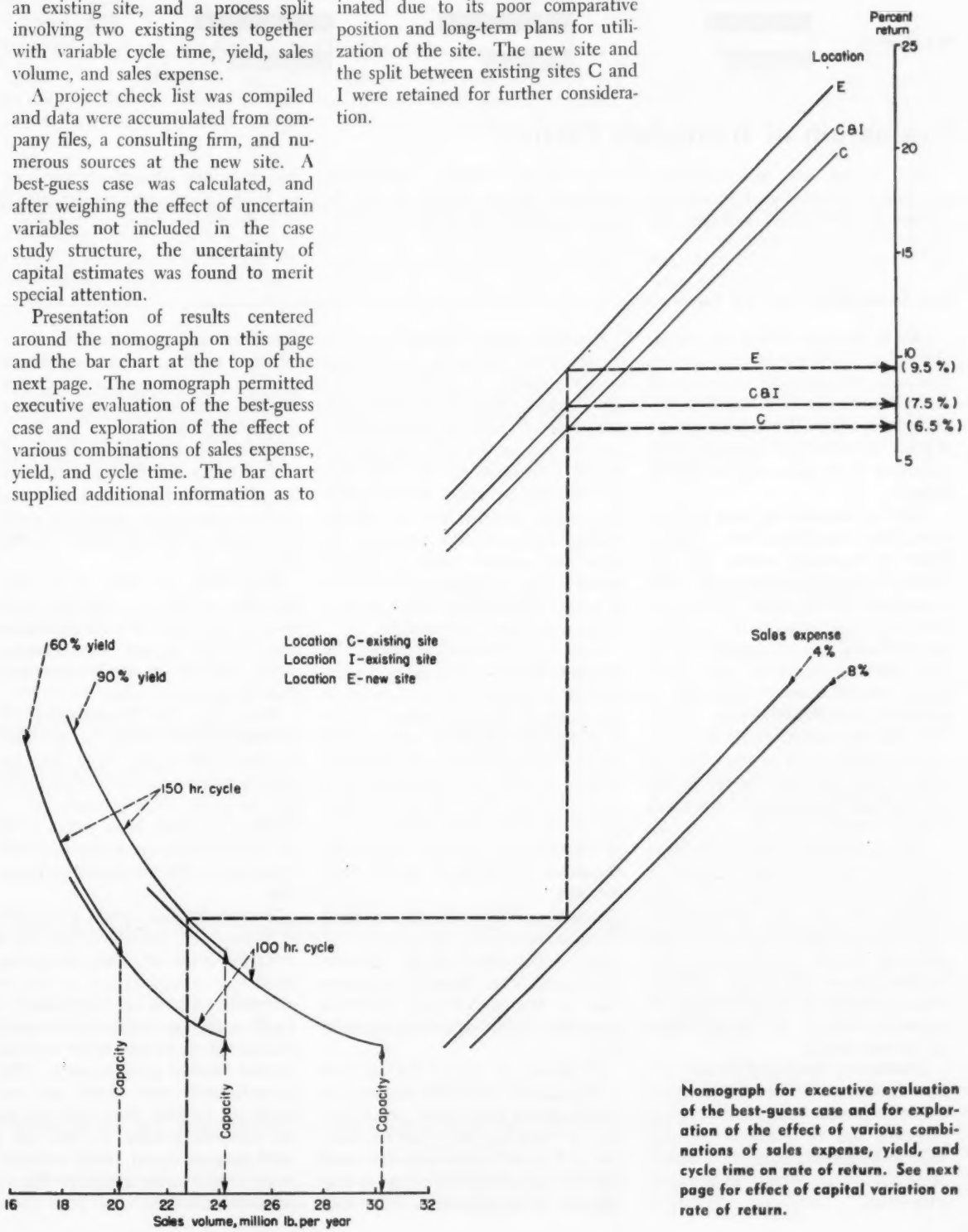
**Example:**

This example is a continuation of the project developed in the preceeding example—where a series of cases were developed involving a new site, an existing site, and a process split involving two existing sites together with variable cycle time, yield, sales volume, and sales expense.

A project check list was compiled and data were accumulated from company files, a consulting firm, and numerous sources at the new site. A best-guess case was calculated, and after weighing the effect of uncertain variables not included in the case study structure, the uncertainty of capital estimates was found to merit special attention.

Presentation of results centered around the nomograph on this page and the bar chart at the top of the next page. The nomograph permitted executive evaluation of the best-guess case and exploration of the effect of various combinations of sales expense, yield, and cycle time. The bar chart supplied additional information as to the effect of capital variation on choice of location.

The case involving location of all facilities at existing site C was eliminated due to its poor comparative position and long-term plans for utilization of the site. The new site and the split between existing sites C and I were retained for further consideration.




**Nomograph for executive evaluation of the best-guess case and for exploration of the effect of various combinations of sales expense, yield, and cycle time on rate of return. See next page for effect of capital variation on rate of return.**

**PLANT SITES . . .**

**Effect of Capital Variation on Rate of Return**

# Evaluation of Intangible Factors

This is the last decision-making step before submission of recommendations to the highest authority for acceptance or rejection. Intangibles, economic factors which cannot be easily evaluated in terms of dollars and cents, may have effects which are far reaching and, perhaps, completely alter the picture based on tangibles.

## List Intangibles for All Cases

Due to the very nature of intangibles, close staff executive participation with the shrewest minds in all major departments is advisable in deriving such a list. While each project requires an individual approach, consideration of the following list may be helpful:

*Effect of Distance or Time on Customer Service and New Sales*—Importance of customer service has increased as competition increased. This is particularly true where custom-produced orders for many small customers are involved. Any attempt to inventory specialty stocks in sales warehouses would mean a high risk in potential product obsolescence—hence loss. The alternative would be to locate a versatile plant in the center of a major sales area and thereby obtain incremental business based on quick delivery service.

*Effect of Project Timing on Share of the Market*—Completion time for a project often varies considerably with location. At a new site "starting from scratch" may take more time than using developed ground and service facilities at an existing site. Where several competitors are grasping at an expanding market, this timing factor can be very critical.

*Community Spirit and Climate at a New Location*—While such factors as employee morale, taxes, waste disposal programs and air pollution probably will not be decisive ones, these factors often carry monetary implications with them.

*Potential Labor Difficulties*—This is not an easy factor to evaluate but should certainly be explored at any new location. Type of employee available, type of union organization (i.e. craft vs. company-wide), and area industry competition for the labor supply available including seasonal variations could possibly lead to difficult staffing, strikes or other problems. In some communities labor is innately unstable due to industry competition or agricultural sidelines which make a stable work force unattainable.

*Location of Research and Staff Department Facilities*—Location of such facilities at or very close to a new plant means good communications, which is particularly important when process or product revisions are inherent. Where research is conducted at a great distance from the plant, there can be extensive costly delays. It may be necessary to provide capital and manpower for research at the new location.

*Impact on Value of Company Stock*—Expansion at the existing or a new location will affect public opinion. Opinion of the financing organizations or the stock-buying public is important to any expanding organization.

If there is a general feeling that an organization is risking too much or spreading too thin, stock prices may fall—or there may be an adverse reaction in financial circles with the result that risk capital would dry up. It is in this area of the problem solution that the alternatives of purchase of an established smaller company or of merger with a company with the desired location and facilities may be extremely important.

*Possibilities for Further Expansion*—To locate a new facility at an existing plant site where land is scarce could negate future expansion needs for a more profitable project at that site.

Also, there are times when location of a project at a new site could open up new fields of endeavor due to new raw material and other opportunities, with the chance for increased diversification and profits.

*Advisability of Centralization or Decentralization*—This factor could be significant to the basic plan for industrial dispersion for national military purposes. Where production is wholly centralized, labor strikes could tie up total company production with a prolonged effect on market participation.

Decentralization could overcome or reduce this possibility and be a profound asset at labor bargaining tables.

*Possible Effects of Legislation*—Tariff reduction, particularly, could produce major changes on raw material or even finished product prices. This is particularly true where raw materials are available from both foreign and domestic sources. In this case a tariff decrease could make a coastal location look more attractive than a mid-continent site.

*Risk in Postponing Complete Expansion by Partial Use of Existing Facilities*—There are times when a new site can be justified only if a large plant is planned. This is particularly true when raw material economics require large volume operations such as in petroleum or allied activities. Where stepwise expansion and existing incremental raw material facilities can and are used, a plan to expand at another location may never be realized. Reliability of sales forecasts must also be considered in connection with this risk.

### Quantify as Many Intangibles as Possible

This is the most difficult step of the entire evaluation. Where no calculations are possible, development of an arbitrary index may be helpful. For example, the evaluation of centralization versus decentralization, possible savings in insurance and estimated losses in the event of disaster may best be indicated by weighted indices.

### Analyze Effect of Intangible Factors Upon Tangible Factor Evaluations

This step should result in a tabular or graphic comparison of all tangible and intangible factors for each location under final consideration. The recommendations should then be submitted to the decision maker.

The following example will clarify this. It involves preparation of the "final evaluation summary."

**Example:**

In the preceding example two cases were selected for the final evaluation—all facilities at new site versus a split of facilities between two existing company sites. Intangibles were listed, evaluated and summarized along with tangibles in the table.

Location C & I was recommended because less over-all risk was involved. Other company plans for expansion were also a factor for this recommendation.

**Final Evaluation Summary**

| | Location C & I | Location E (New Site) |
|---|---|---|
| "Best guess" return | 7.5% | 9.5% |
| Poorest return | 7.0% | 7.5% |
| Capital | ..... | 11% higher than C & I |
| Possible capital overrun | 11% | 20% |
| Project timing | 18 mos. | 2 yrs. |
| Market loss due to timing | None | 10% initially |
| Potential raw material obligation at reduced capacity | Minimum risk—due to alternate uses | 100% |
| Effect on company stock | Plus | Minus—due to the opening of several new sites recently, an additional new site might be viewed as spreading man-power and other resources "too thin." |

## Correlation and Presentation of Final Case Evaluations to Management

Most companies have a capital-appropriations request form which covers this step. Since all data for both the recommended action and alternatives now are available, preparation of the request will involve a minimum of effort.

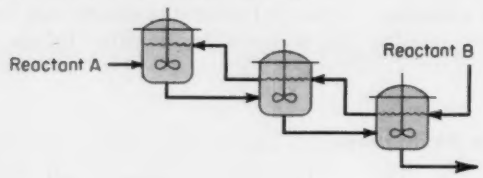
The executive will have sufficient supporting information to make his recommendations with confidence as a result of the studied, logical solution of the problem.

## Management Decision—Acceptance or Rejection

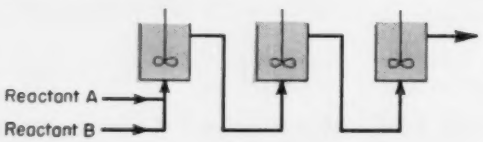
By having the request prepared by the above described method, top management has available information based on sound analyses. The most practical and attractive cases are indicated with their degree of recommendation. Management is now prepared for its task of final decision—acceptance or rejection.

**Batch:**

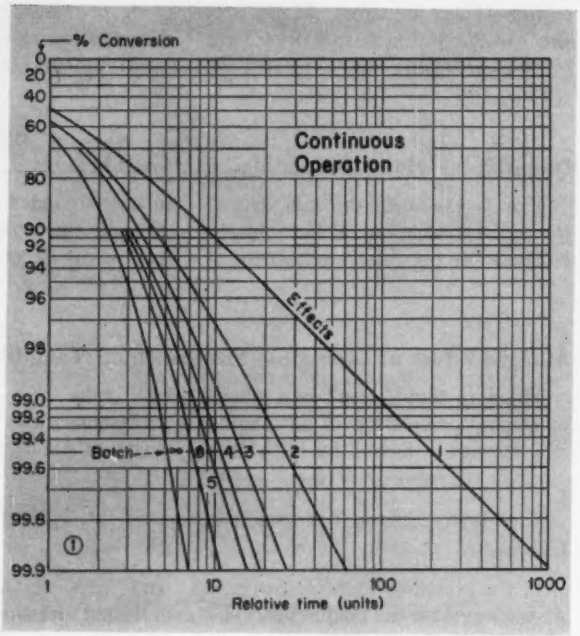
**Continuous Countercurrent:**




**Continuous Concurrent:**




**1st Order Reactions**




# Charts Simplify Job of Designing Your

**Here are nine charts which will simplify or eliminate much of the tedious calculations involved in designing for the best chemical reactor system**

**T. M. JENNEY,**
**Food Machinery and Chemical Corp., Beeco Div.**

DESIGNING a system to handle a reaction can be a difficult and time-consuming job.

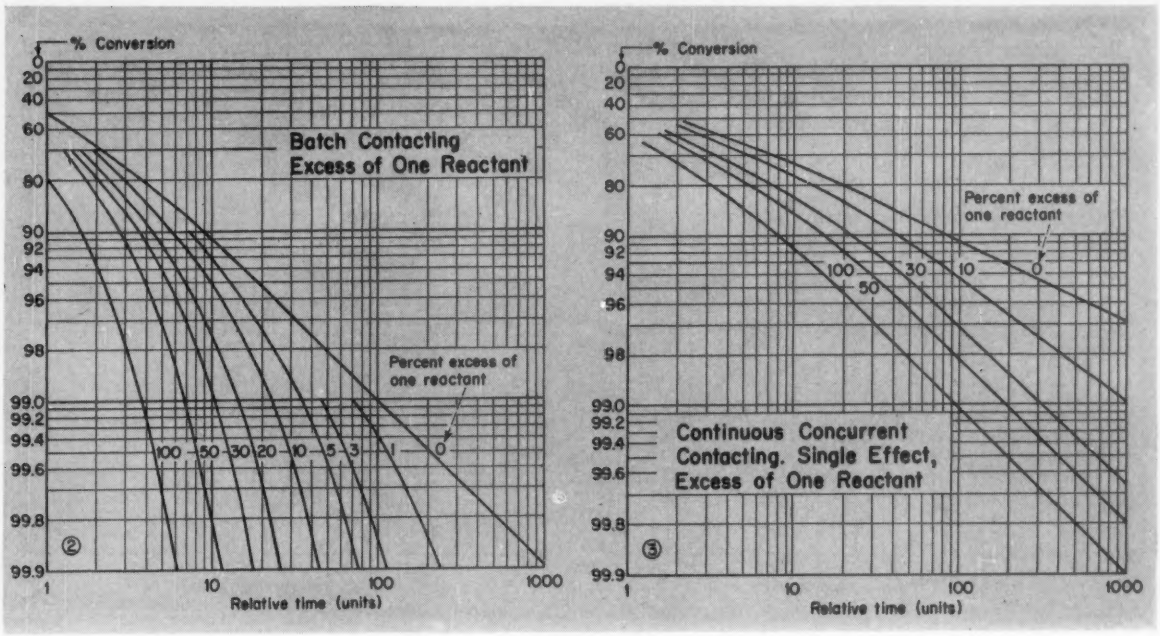
A batch or a continuous operation of one or more stages may be the most economical reaction system. Any optimum system must take into account reactor investment and operational costs, which are dependent on production level and reaction rates. Chemical reaction rates are influenced by many factors: concentration, temperature, pressure, catalyst, etc. The tedious task of designing a reaction system is further complicated by the extensive calculations required to establish the most economical excess of reacting components as well as the most economical conversions.

The graphs presented here simplify the determination of concentration effects and the sizing of reaction systems, for apparent or pseudo first or second order reactions. Reaction system design, using the graphs, can be made on the basis of apparent or pseudo order reactions. The true order of the reaction need not be known.

For a specific reaction system, you need to know the order of reaction and one point of conversion for a given time at given conditions of concentration and temperature. Then with these graphs, you can rapidly determine the effect of conditions such as, change of contact time, number of contacting effects, direction of flow, or combinations. Required calculation is negligible and visual inspection of the graphs is often sufficient for choosing the best reaction system.

Other variables that would have some effect on the reaction rate, such as constant volume, constant pressure, and temperature, or temperature gradients, have been neglected. These effects can be inserted by the designer after using the graphs.

The graphs have been constructed using a relative time unit. Each of the figures was constructed in a similar manner, assigning the rate constant $k$ a value of one, the original concentration of the component reported as % converted equal to one, and the other reactant equal to one plus the excessive fraction. This allows you to transfer points from one curve to another. In the case where more than one stage is used, they are of equal volume




# Reactor System

and, therefore, of equal contact time. The contents of each reactor are assumed to be completely mixed.

### How to Use the Curves

Here are examples of the use of the various curves, showing the simple mechanics involved in solving for the effects of methods of contacting, excess reactant, and time.

*Example 1*—In the case of the hydrolysis of chlorobenzene to phenol, using a large excess of caustic, the reaction is pseudo first order with respect to the chlorobenzene concentration due to the large excess of caustic. A batch reaction was carried out for two hours and a conversion of 98.1% was obtained.

*Solution*—From Fig. 1, four relative time units are necessary for 98.1% conversion, under batch conditions. One hour, therefore, equals two relative time units. (If four minutes had been required, a relative time unit would equal one minute.)

From Fig. 1, the time required for the same degree of conversion, using a one stage continuous reactor, can be read as 52 relative time units, which equals 52/2 or 26 hours.

From Fig. 1, six relative time units are required for 98.1% conversion, using a five stage continuous reaction system, and the time required would be 6/2 or 3 hours.

The time to obtain any conversion for any first order system can be determined using Fig. 1.

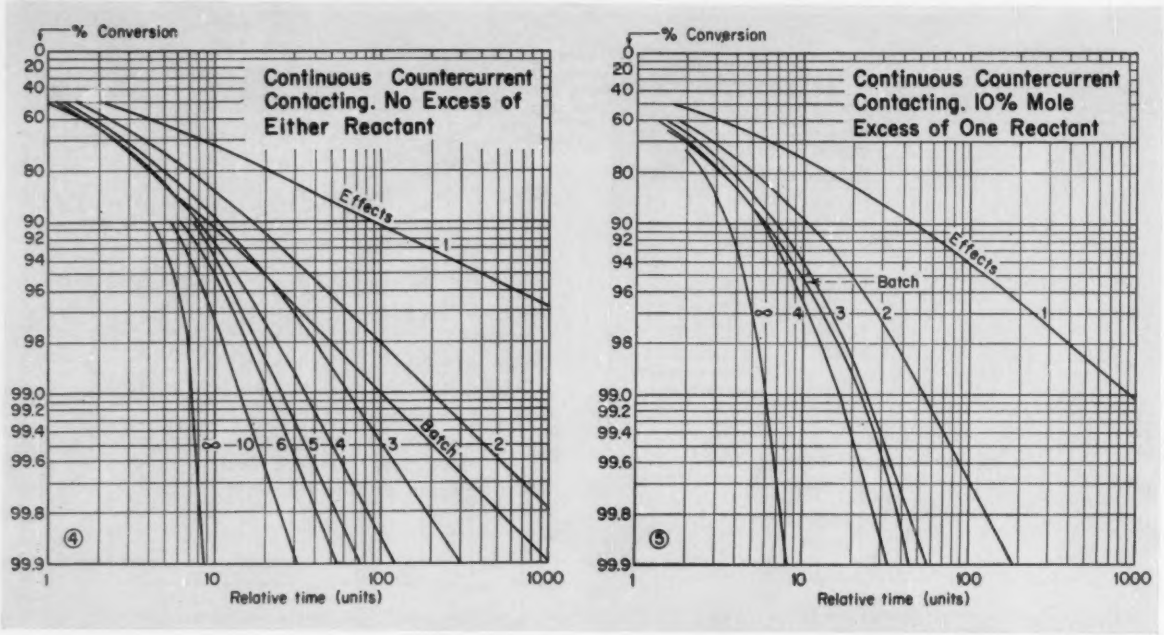
You can get the volume of the system by multiplying the production rate desired by the time necessary for the required conversion in the reaction system, making allowance for freeboard, charging the system, etc. If the flow rate through the reacting systems is to be 100 gal./hr., the size of the reactor for handling the one stage continuous system would be (100 gal./hr.) ( 26 hr.) or 2600 gallons plus freeboard, etc. The five stage system would require a total of only (100 gal./hr.) (3 hr.) or 300 gallons plus freeboard, etc.

*Example 2*.—In the case of the saponification of ethyl acetate with an aqueous solution of sodium hydroxide, the reaction is second order. A batch reaction gave 98% conversion of acetate after two hours, when no excess of sodium hydroxide was charged.

*Solution*—From Fig. 4 or 7, read 50 relative time units for 98% conversion, when contacting batchwise with no excess of either reactant. One hour equals, therefore, 25 relative time units. To produce 100 gal./hr. at 98% conversion, the reactor volume would have to be (100 gal./hr.) (2 hr.) or 200 gallons plus freeboard, etc.

You can get conversion that would have been obtained from a single-stage continuous reactor in the same time by following the vertical line from 98% conversion on the batch line to the single stage conversion line, which is crossed at 86.8% conversion. (Fig. 4 or 7)

From Fig. 7, 115 relative time units are required for 98% conversion, using four stages of concurrent contact-




ing. The time would, therefore, be 115/25 or 4.6 hours. Reactor volume would have to be (100 gal./hr.) (4.6 hr.) or 460 gallons plus freeboard, etc. to maintain a 100 gal./hr. production level.

Relative time units required for 98% conversion, using four stages of countercurrent contacting, can be taken from Fig. 4 as 24. The time would, therefore, be 24/25 or 0.96 hours. Total reactor volume required to process 100 gal./hr. would be (100 gal./hr.) (0.96 hr.) or 96 gallons plus freeboard, etc.

For a 10% excess of one reactant and reacting batchwise, the relative time units required for 98% conversion is available from Figs. 2, 5, or 8 as 17. The time required would be 17/25 or 0.68 hours, which requires a reactor of (100 gal./hr.) (0.68 hr.) or 68 gallons, plus allowance for freeboard, etc. to maintain 100 gal./hr.

The relative time units for three hours would be (3)(25) or 75. At 75 relative time units the batch reaction would be 98.7% complete.

Although unlimited examples could be given for using these figures, these examples should acquaint the reader with the graphs.

## Theory and Method of Graph Construction

In 1935 MacMullin and Weber[2] presented a paper entitled "The Theory of Short-Circuiting in Continuous-Flow Mixing Vessels in Series and the Kinetics of Chemical Reactions in Such Systems". This presentation was very complete; however, considerable calculations are required to size a reaction system using the information contained in this paper.

In 1943 Hurt[3] introduced the concept of reaction units. In 1951 Caddell and Hurt[3] extended the original paper. These papers presented a simplified, labor-saving system for the designing of reaction systems; however, considerable calculating is still required.

The graphs presented in this article are an attempt at simplifying and eliminating much of this calculation.

Calculations required to lay out each of the curves are quite detailed; therefore, only one set of partial calculations will be included here. The somewhat involved system required for the construction of Fig. 4 was chosen. Here the system is a second order countercurrent continuous reaction with no excess of either reactant.

The substitution chlorination of hydrocarbons such as benzene, with the chlorine and benzene contacted by countercurrent flow is a typical example of this system.

A second order reaction is a bimolecular reaction where the velocity may be stated as:

$$dC/dt = -kC_AC_B$$

where C is concentration and t is time.

In the case where $C_A = C_B$

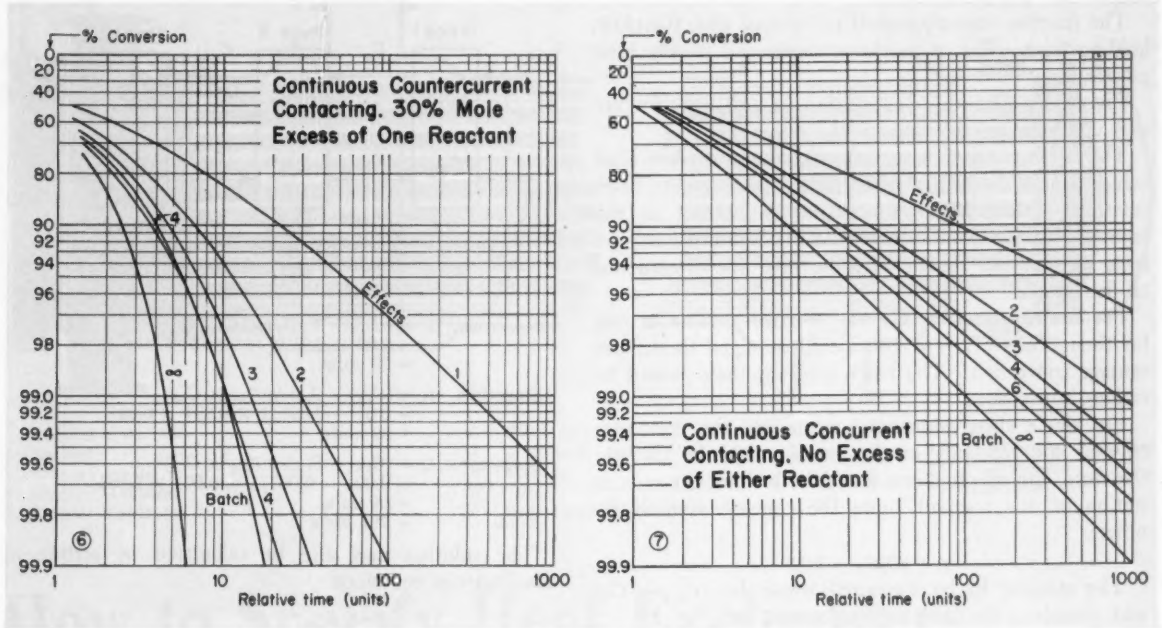
$$dC/dt = -kC_A^2 = -kC_B^2 = -kC^2$$

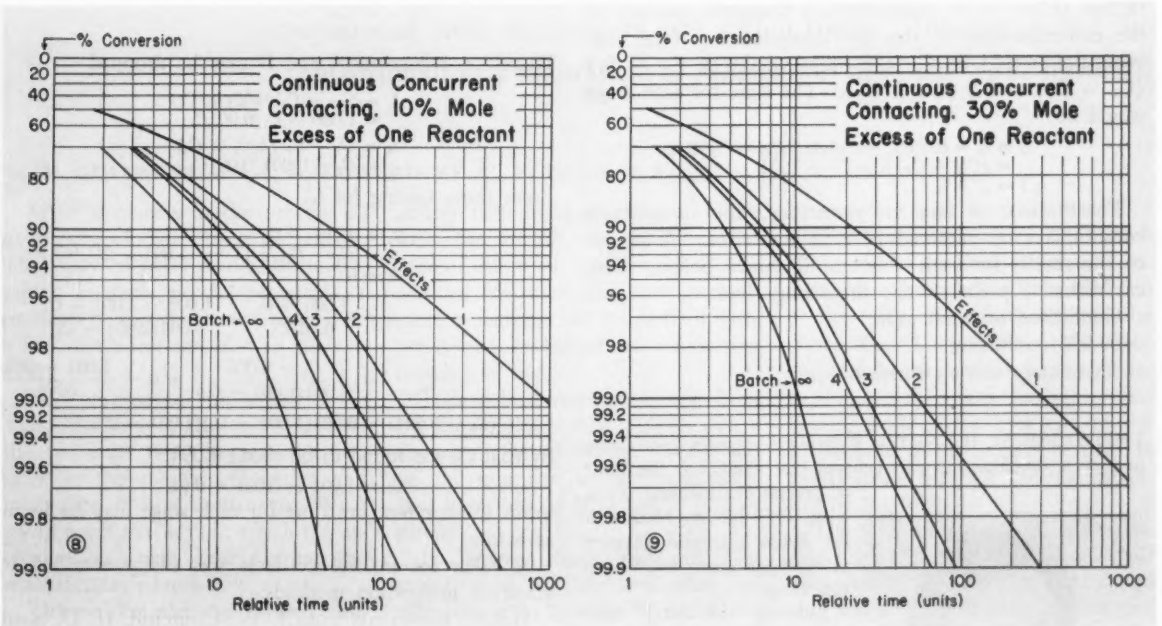
Integration gives the relation

$$1/C_F = 1/C_O + kt \quad \text{or} \quad k = (C_O - C_F)/tC_OC_F$$

## Nomenclature

| | |
|---|---|
| $k$ | Rate constant (units$^{-1}$). |
| $C_A$, $C_B$ | Concentration of reactants *A* and *B*. |
| $t$ | Time (units) |
| $C_O$, $C_F$ | Concentration original, concentration final. |
| $C_1$, $C_2$, $C_3$ | Concentration stage 1, 2, and 3. |
| $r$ | Rate = conversion of *A* in fraction/unit time. |




$k$ = the reaction rate constant in reciprocal time.

$t$ = unit of time.

$C_o$ = the concentration (moles/unit volume) of the original reactants.

$C_f$ = the final concentration of the reactants.

This equation and Fig. 4 are for reactions where reacting equivalents are charged. The lines for Fig. 4 were constructed using a value of one for $k$. Since $k$ is inversely proportional to time, the units of time are relative for any value of $k$ and may be used in this manner. If the $k$

value is known, the time may be treated in a similar manner for the same reason.

The reactors were equivalent in volume, and, therefore, holding time. This is nearly optimum and usually most practical.

Fig. 4 is a plot of % conversion in unit time for various combinations of equipment.

The batch conversion vs. time was also plotted to allow comparison of continuous countercurrent designs to batch reaction. Most investigations are carried out in this manner and the data extrapolated to countercurrent systems by methods similar to those used for construction of this graph.

For the construction, $C_o$ was assigned a value of one, for then $(C_o - C_F) \times 100$ would be equal to the percentage conversion. The batch line was then plotted for various conversions.

For single stage continuous operation, the concentration of the reactants in the vessel would be $C_F$ and, therefore, the effective rate would be $k$ times the concentration of one reactant times the concentration of the other:

$$r = kC_FC_F = kC_F^2$$

The amount to be converted would be $(C_o - C_F)$ and, therefore, the time required would be:

$$t = (C_O - C_F)/kC_F^2$$

For two stages, by similar analogy, each stage requires time equal to the conversion of one-half of the total conversion $(C_o - C_F)$. The rate is $k$ times the product of the concentrations of the two components. One concentration would be $C_F$; the other would be $C_o - 0.5\ (C_o - C_F)$ or $0.5\ (C_o + C_F)$. The time for each stage would be:

$$t_1 = t_2 = 0.5(C_O - C_F)/0.5(C_O + C_F)C_Fk$$
$$= (C_O - C_F)/C_F(C_O + C_F)k$$
$$t = t_1 + t_2$$

For the case of three or more stages the approximate conditions were obtained by trial and error. A sample of the results for such a system is shown below. This established a point on the three stage line.

Conditions imposed were:

99.9% conversion.

Three stage and $C_o$ equals one.

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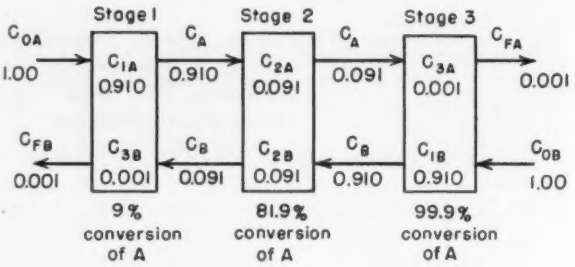
**Each stage should have equal holding time**




Stage one, $t_1 = (C_{OA} - C_{1A})/k(C_{1A} \times C_{3B})$
$= 1.00 - 0.91/1 \times 0.91 \times 0.001$
$= 99$ units

Stage two $t_2 = (C_{1A} - C_{2A})/k(C_{2A} \times C_{2B})$
$= 0.91 - 0.091/1 \times 0.091 \times 0.091$
$= 99$ units

Stage three, $t_3 = (C_{2A} - C_{3A})/k(C_{3A} \times C_{1B})$
$= 0.091 - 0.001/1 \times 0.001 \times 0.091$
$= 99$ units

Total $= 297$ units

The solution may also be calculated by setting up simultaneous equations.

$$t_1 = t_2 = t_3$$
$$C_{OA} = C_{OB} = 1.00$$
$$C_{3A} = C_{3B} = 0.001$$

Since the system is symmetrical.

$$C_{1A} = C_{1B}$$
$$C_{2A} = C_{2B}$$

Therefore, subscripts A and B may be dropped

$$t_1 = (C_O - C_1)/k(C_3 \times C_1)$$
$$= 1.000 - C_1/0.001C_1$$
$$t_2 = (C_2 - C_3)/k(C_1 \times C_2)$$
$$= C_2 - 0.001/0.001C_1$$

From these solving for $C_1$

$$C_1 = 1.001 - C_2$$
$$t_2 = (C_1 - C_2)/k(C_2)^2 = 1.001 - 2C_2/(C_2)^2$$
$$t_1 = t_2$$

$$t_1 = \frac{1.000 - C_1}{0.001C_1} = \frac{1.000 - 1.001 + C_2}{0.001(1.001 - C_2)}$$

$$= \frac{C_2 - 0.001}{0.001(1.001 - C_2)} = t_2 = \frac{1.001 - 2C_2}{(C_2)^2}$$

$$(C_2)^2(C_2 - 0.001) = 0.001(1.001 - C_2)(1.001 - 2C_2)$$

By trial $C_2$ was found to be about 0.091

$$C_1 = 1.001 - 0.091 = 0.91$$

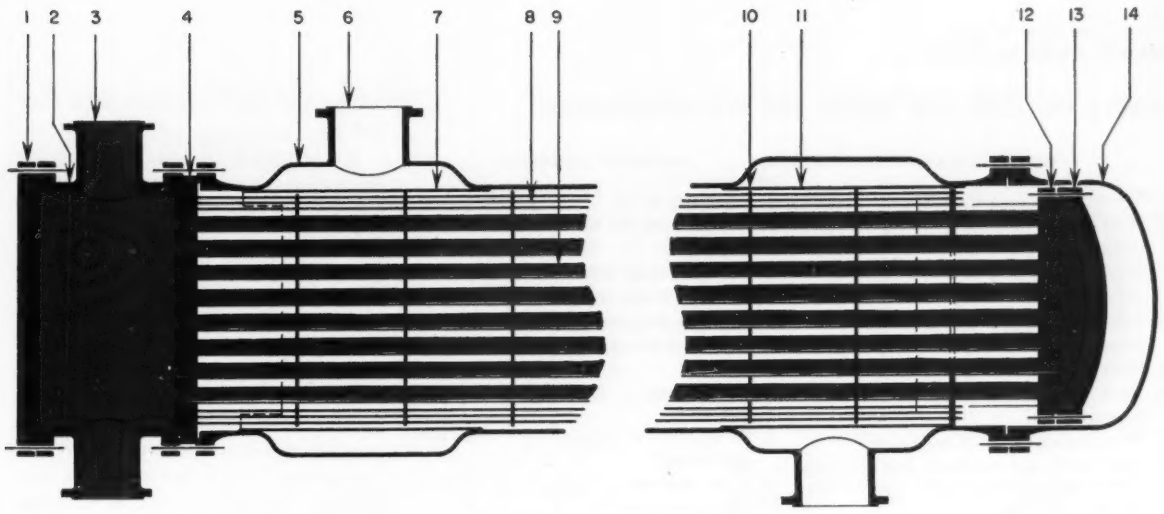
With these values the time for each stage may be found as before.

A value for infinite contacts was easily obtained by graphical integration methods.

Helpful comments from J. W. Churchill, H. D. Kaufmann, B. H. Nicolaisen, and J. E. Troyan of Olin Mathieson Chemical Corp.'s Research Laboratory are acknowledged with thanks.

REFERENCES

1. MacMullin, R. B., and Weber, M., *Trans. AICHE* May 1935, (preprint) 48 pp.
2. Hurt, D. M., *Ind. Eng. Chem.*, 35, p. 522 (1943).
3. Caddell, J. R., and Hurt, D. M., *Chem. Eng. Progress*, 47, p. 333 (1951).




1 Channel cover
2 Channel
3 Channel nozzle
4 Channel tubesheet
5 Annular distributor
6 Shell nozzle
7 Distributor sleeve
8 Tierods
9 Tubes
10 Segmental crossbaffle
11 Shell
12 Floatinghead tubesheet
13 Floatinghead
14 Shellcover

# How to Specify Heat Exchangers

**As process specialists you have demanded more complicated heat exchangers and gotten them. However, using the manufacturer's knowledge of fabrication may ease your burdens.**

**W. E. GLAUSSER and J. A. CORTRIGHT, C. F. Braun & Co.**

Many engineers in the process industries work with heat exchangers. They may be plant process engineers, piping designers, purchasing agents or production supervisors, to name just a few. Each is a specialist in his own field.

The purpose of this article is to acquaint the specialist with some of the problems that the manufacturer faces in the mechanical design and fabrication of heat exchangers. We'll try to point out ways in which the exchanger user can benefit from the manufacturer's know-how.

This subject can be divided into these main topics:

- Heat exchange in general.
- Process design.
- Mechanical design.

We'll discuss each of these in the sections that follow.

### MAIN CONSTRUCTION TYPES

Originally, heat transfer rates were strictly rule-of-thumb guesses. Gradually the art of heat exchange has become more of a science; and the demand for more and more complicated exchangers has led to the highly specialized exchanger manufacturing industry of today.

Today's heat exchangers range from the simple pipe within a pipe—with a few square feet of transfer surface—up to the complex surface condensers that have thousands of square feet of surface.

In between these extremes is a broad field of shell-and-tube exchangers often specifically named by distinguishing design features. For example, we have U-tube, fintube, fixed-tubesheet and floating-head exchangers. The floating-head exchanger shows great operating flexibility and lends itself to easy maintenance and repair. Therefore, most of our discussion will center on this type.

Let's look briefly at the general construction and nomenclature of a shell-and-tube exchanger. The sketch above shows sections of typical exchangers. The tubebundle is made up of the tubes, the tubesheets and the crossbaffles. The channel at the front end of the exchanger serves as a header to feed the fluid into the tubes. The floating head at the back end of the tubebundle is the return header. It moves freely with the thermal expansion of the tubes.

The shell unit is essentially a cylinder with a bolting flange at each end. The channel bolts to the front flange and the shell cover bolts to the rear flange.

### STANDARDIZATION

Most manufacturers have standard lines of exchangers. The standards establish diameters and pressure classes, and promote the use of standard drawings and standard fabricating procedures.

## What's the Least You Should Tell the Manufacturer?

| Process Information | Mechanical Information |
|---|---|
| 1. What are the fluids?* | 1. What size tubes? |
| 2. What are the fluid quantities tubeside and shellside? | 2. How long are the tubes and what is their gage? |
| 3. What are the temperatures in and out of the exchanger? | 3. Minimum design pressure? |
| 4. How much material is vaporized or condensed in the exchanger? | 4. Minimum design temperature? |
| 5. What is the operating pressure? | 5. Is there a corrosion allowance? |
| 6. What is the allowable pressure drop across the exchanger? | 6. Any pressure-vessel or special state codes involved? |
| 7. What fouling factor do you require? | 7. Do you want a special tubefield layout and pitch? |
| 8. Heat load? (Not necessary, but including it may help uncover potential errors in the process.) | 8. Do you have a preference for nozzle size and facing? |
| | 9. What materials of construction for shellside and tubeside?† |

*If the fluids are uncommon, the properties needed to predict heat transfer rates should be included. These are specific heat, density, viscosity and thermal conductivity.

†When special materials are required it's best to give reasons for your choice. Manufacturer may point out fabrication difficulties and suggest alternate materials.

With standardization the fabricator can cut down the time for engineering and design and build exchangers faster. The fabricator tools his factory with specialized machines designed to produce standard parts at least cost in the shortest time. However, standardization does not mean that most exchangers can be delivered off the shelf. Service requirements vary too much. Some engineering is necessary for almost every exchanger and sometimes operating conditions require special exchangers.

But if service conditions permit the use of exchangers built to standard lines, the buyer saves money.

### SPECIFICATION AND BIDS

Many users of heat exchangers have their own ideas about design and fabrication. They write specifications to insure that an exchanger meets certain minimum requirements. The owner must use care in the preparation and in the application of these specifications. They must be complete, detailed and specific if they are for equipment purchased from a job shop that has no design engineers and makes no performance guarantee.

If they are going to a completely-equipped exchanger fabricator, the specifications should allow some freedom. Then the owner can benefit from the fabricator's know-how and experience. And he benefits from the two advantages of a standard exchanger: lower cost and interchangeability.

Small deviations from the manufacturer's standard line can increase the exchanger cost greatly. The manufacturer's standard almost always meets the requirements of the customer and should be used.

The engineer who selects and designs heat exchangers is usually an expert in his field. Often he has had experience in plant operation. He can usually recommend the best equipment for each individual case.

Sometimes he can save the purchaser a great deal of money. But before he can make suggestions he must know something about the process conditions. Too often inquiries for exchangers do not include enough information.

Even people who are completely familiar with bid requests sometimes omit important data and seemingly small omissions can affect exchanger selection considerably. The table above gives the minimum process and mechanical design information that is required to arrive at the best and most economic selection—especially if bids from several manufacturers must be evaluated.

### PICK A TUBE SIZE

The buyer should always specify a tube size in his inquiry. Here's why

There are three common tube sizes for heat exchangers: $\frac{5}{8}$, $\frac{3}{4}$ and 1 in.

Exchangers with $\frac{5}{8}$-in. tubes are the least expensive in cost per sq. ft. of surface, because the given surface fits into a smaller shell diameter. But the $\frac{5}{8}$-in. tubes are more difficult to clean than larger tubes. Higher maintenance costs may soon eat up the difference in exchanger first cost.

The $\frac{3}{4}$-in. tubes are much easier to clean. Except for conditions of severe fouling, $\frac{3}{4}$-in. tubes are usually the most economic in the long run. When the intube fluid is known to be very fouling—and when frequent cleaning is anticipated—the tubes may be 1 in. or larger.

The heat exchanger manufacturer is not in as good a position to judge the fouling tendencies as is the operator. Therefore, the buyer should always specify the tube size in his inquiry.

## Process Design

Engineers have come a long way in solving the mysteries of heat transfer, but there is still much to learn. Heat transfer studies intubes in the turbulent region is pretty well tied down. Almost any textbook shows a good method for computing heat transfer for intubes for turbulent flow. But for heat transfer intubes in the laminar region, or heat transfer inshell in both the laminar and turbulent regions, it is virtually impossible to get help from the literature.

Many articles discuss these phases of heat transfer. Most of them show good correlations for individual sets of data. But crossplotting data from various investigations results in contradiction and confusion. In addition, heat transfer for condensers and reboilers is not covered very well by the literature.

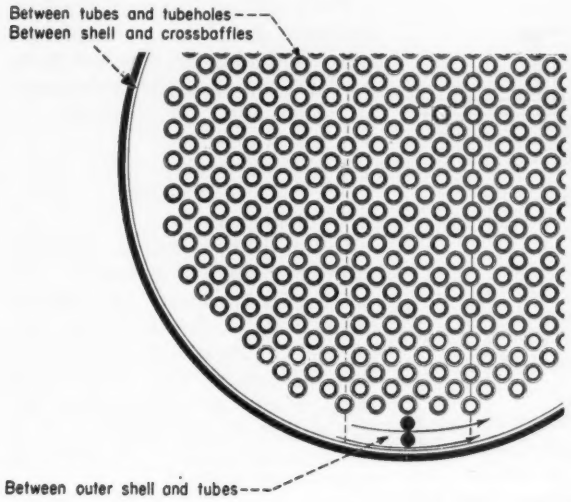
As a result, the manufacturers of heat transfer equipment must devise their own methods.

### SHELLSIDE BYPASSING

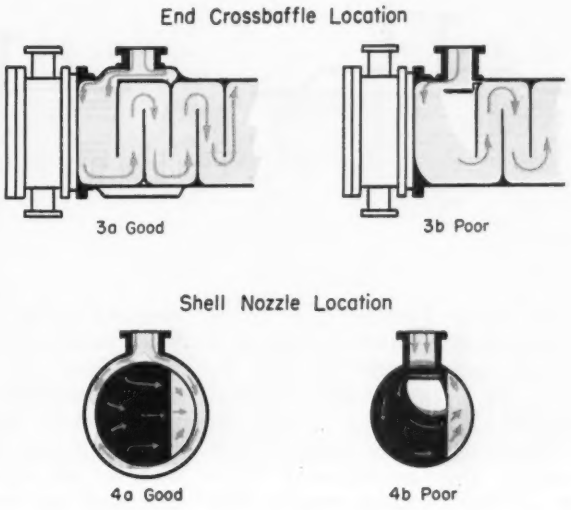
Inshell heat transfer rates are very difficult to predict. They can vary widely with bypassing that is caused by manufacturing methods and tolerances. The shellside fluid can partially bypass the tubebundle in three ways:

- Through the clearance area be-

**Where Shell Fluid Can Bypass**




**Effective and Ineffective Surface**




tween the segmental crossbaffles and the shell.

• Through the clearance area between the tubes and tubeholes in the crossbaffles.

• Between the outermost tubes and the shell.

The amount that bypasses is determined not only by these design clearances but also by manufacturing tolerances on shell roundness, baffle diameter and tubehole clearance. Effect of fluid bypassing on the shellside transfer rate varies considerably with the source.

The study of shellside bypassing is a major research program in itself. And it must be conducted on full-scale exchangers with realistic manufacturing tolerances.

#### FOULING FACTOR

Almost all exchangers are designed with an allowance for fouling. Ideally this allowance represents a service factor. During operation a dirt film gradually builds up on the tube surfaces. The dirt may be rust, boiler scale, silt, coke or any of a number of other things. In effect, fouling factor represents additional surface to offset the decrease in heat transfer rate caused by the dirt deposit.

Usually, the manufacturer cannot predict the nature of the dirt deposit nor the rate of fouling. Since these things are beyond his control, he can only guarantee the performance of a clean, new exchanger.

Some heat exchanger buyers specify the minimum surface acceptable for each exchanger. To compute the surface they use transfer rates found in the literature. Or they use surface transfer rates from existing heat exchangers.

On the face of it this may sound like good practice. But specifying surface reduces the manufacturer's role to that of filling an order. The buyer fails to benefit from the manufacturer's research program and his wide experience with many users.

Specifying the surface precludes the engineering of the best selection for the specific case. The inquiry for an exchanger should not specify the surface but it should specify the fouling factor.

#### INEFFECTIVE SURFACE

Crossbaffles divide the shellside of an exchanger into small flow compartments. Usually the distance from the tubesheets to the nearest crossbaffle is greater than the distance between any two adjacent crossbaffles. This extra space is necessary because the shell nozzles cannot be installed close to the tubesheets. The nozzle weld must clear the shell weld at the end flange (see sketch above).

The velocity of the shellside fluid in the end crossflow passages is lower than in the other passes. Since the transfer rate decreases with velocity, the surface in the end passes is only partially effective.

In an exchanger 16 ft. long, the partially effective surface can be as much as 20% of the total surface in the exchanger. This ineffective surface can be kept to a minimum by proper location of the end crossbaffles and by mounting the nozzles on annular distributors.

#### TUBEFIELD LAYOUT

Another important consideration in the design of heat exchangers is the tubefield layout. Most exchangers use either a 60° or a 90° layout.

A 90-degree layout provides cleaning lanes between the rows of tubes. But the 60-degree layout has more surface in a given diameter. Therefore, it costs less per sq. ft. The 60-degree tubefield layout is used for clean service or when chemical cleaning of the shellside is possible.

## Mechanical Design

The mechanical design and fabrication of almost all heat exchangers follows one of two pressure-vessel codes. These are the 1954 API-ASME Code for Unfired Pressure Vessels, and the 1952 ASME Boiler and Pressure Vessel Code, Section VIII. Customer preference or local laws determine the

## Distortion from Nozzle Welding Can Shrink Shell

5a Good weld

5b Distorted weld

code. Some localities have special requirements. Therefore, the user should always specify the code, because he is familiar with the local practice.

Proper selection of materials is important. There are four major factors to consider: corrosion; strength; cost; and fabrication problems.

Normally the user is in the best position to evaluate his corrosion problems. And he can best select the type of material or the corrosion allowance to meet his needs.

### AVAILABLE DESIGNS

If you specify a shell-and-tube heat exchanger with a floating tubebundle rather than one with a fixed tubebundle, you should bear in mind that there are several variations in the design of removable tubebundles. These include: pull-through floating heads; splitring floating heads; U-tubebundles; and pillbox channels. Each of these variations has certain advantages. Some save in first cost and others in maintenance.

It is beyond the scope of this article to discuss these modifications here, but you ought to consider their differences and advantages when talking about mechanical design with a manufacturer.

### FABRICATION

Mechanical design goes hand in hand with fabrication in the building of a good heat exchanger. Little is accomplished with a first-class design if the fabrication is not of equal quality.

True, a certain degree of quality is guaranteed by the pressure-vessel codes. But these codes are written primarily for columns and tanks, not for heat exchangers. And many of the important points in the fabrication of exchangers are not even mentioned.

The buyer and fabricator of a heat exchanger should be thoroughly familiar fabricating practices and problems that can affect the performance of an exchanger. These include:

- Shell roundness.
- Nozzle welding.
- Flanges and gaskets.
- Bolting stress.

One of the main sources of trouble in the fabrication of exchanger shells is the nozzle welding. The welding tends to shrink the shell and cause a flat spot. Careful welding can minimize this effect. The sketch above shows a case of nozzle-welding distortion.

### FLANGES AND GASKETS

The standard heat exchanger has four bolted joints: the channelcover; channel to shell; shellcover; and the floating head.

Pressure-vessel codes cover the design of flanges, but the selection of gasket material, flange facing and fabrication procedure are left to the discretion of the user.

Gaskets must be able to withstand service conditions and form good seals. They should be re-usable and lend themselves to easy handling. Replacements should be readily available. Of the common materials, the solid metal gasket best suits most services.

A word about bolting stress. The studs in a conventional gasketed joint should be tightened to develop a bolt stress of 40,000 to 60,000 psi.

### ROUGH DIMENSIONS

As a rule-of-thumb guide to aid in early layout planning, here are some average dimensions of typical exchangers: over-all length = tubelength + 3 ft.; space for tubebundle removal = 1 tubelength from the channel cover; channel nozzle to front shell nozzle = 3 ft.; front to rear shell nozzle = tubelength less 4.5 ft.; space to remove shellcovers = 2 ft. beyond shellcover; nozzle projection = ½ the exchanger diameter + 10 in.; foot projection = ½ exchanger diameter + 5 in.; outside diameter of end flanges = exchanger diameter + 8 in.; and spacing of exchangers side by side with nozzles bolted together = exchanger diameter + 2 ft.

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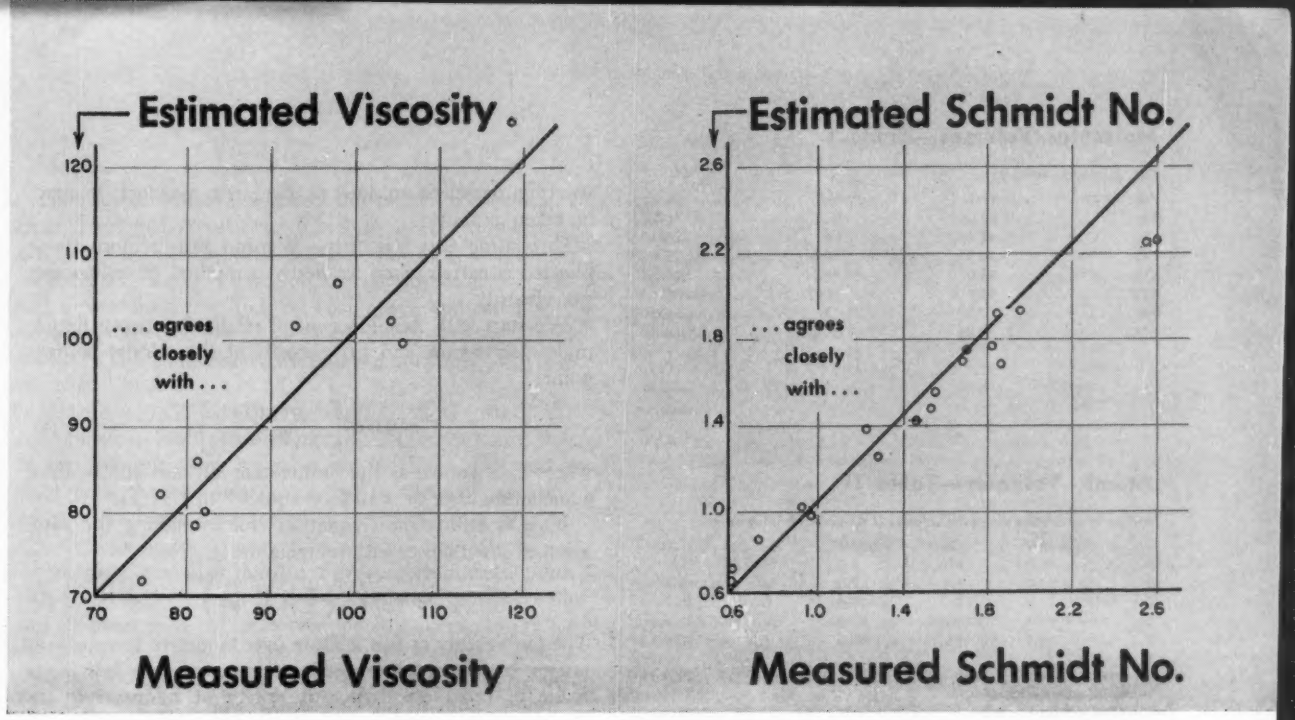



# To Estimate Mass-Transfer Factors

**. . . when you don't know the physical properties, use the correlations given here for various conditions of composition, temperature and pressure.**

**W. R. GAMBILL, Carbide & Carbon Chemicals Co.**

Chemical engineers working with problems in mass transfer make frequent use in their calculations of a dimensionless group known as the Schmidt number. This group, $\mu/\rho D$, expresses the ratio of molecular momentum transfer $\mu/\rho$ to molecular diffusivity $D$.

The Schmidt number enters the picture wherever mass transfer occurs via convection, such as in drying, gas absorption and solvent extraction. It must be considered even in such problems as condensation of a vapor in the presence of a noncondensable gas, where the condensable vapor must diffuse through the noncondensable gas to the heat-transfer surface.

However, we don't always have measured values of viscosity, density and diffusivity for the particular system involved in our problem. This is unfortunate, since the Schmidt number may vary by a factor of at least 12 for gaseous systems under various conditions (unlike its heat-transfer cousin, the Prandtl number, which varies over a range of only about two-fold).

Where we don't know the system properties we may attempt to predict them by means of generalized correlations. In this article we shall develop suitable correlations for predicting Schmidt numbers under various conditions of composition, temperature and pressure. The conditions are set up as three different cases. If we accept certain restrictions, the solution is relatively simple; the general case gets quite complicated.

## Case I

**Composition—Binary gas mixture with one component in low concentration.**
**Temperature—400 F. maximum.**
**Pressure—Low or moderate.**

Let's consider diffusivity first. This property varies slightly with concentration of the components, but not enough to matter in engineering computations. Where the molecular weights of the two components are of the same order, variation of diffusivity with concentration is only 2 or 3%. Even with extreme differences in molecular weights the variation will not exceed 13%.

This means that we are safe in neglecting concentration effects and may use the semitheoretical equation of Gilliland[8] for estimating diffusivity. Simplified and converted to engineering units, this equation is as follows:

$$D = \frac{0.2445\,T^{1.5}(M_A + M_B)^{0.5}}{P(M_A M_B)^{0.5}(V_A^{0.33} + V_B^{0.33})^2} \qquad (1)$$

where $T$ is absolute temperature, $P$ is total absolute pressure, $M_A$ and $M_B$ are molecular weights of components $A$ and $B$, and $V_A$ and $V_B$ are liquid molecular volumes of components $A$ and $B$ at their normal boiling points. (See Nomenclature for units).

From the usual definition of the problem, we will know $T$, $P$, $M_A$ and $M_B$. What about $V_A$ and $V_B$?

## Molecular Volumes—Table I

Each at normal boiling point

| | | | |
|---|---|---|---|
| Air | 29.9 | $H_2S$ | 32.9 |
| $Br_2$ | 53.2 | $I_2$ | 71.5 |
| $Cl_2$ | 48.4 | $N_2$ | 31.2 |
| CO | 30.7 | $NH_3$ | 25.8 |
| $CO_2$ | 34.0 | NO | 23.6 |
| COS | 51.5 | $N_2O$ | 36.4 |
| $H_2$ | 14.3 | $O_2$ | 25.6 |
| $H_2O$ | 18.85 | $SO_2$ | 44.8 |

## Atomic Volumes—Table II

For use in calculating molecular volumes at the normal boiling point

| | | | | | |
|---|---|---|---|---|---|
| As | 30.5 | Ge | 34.5 | S | 25.6 |
| Bi | 48.0 | H | 3.7 | Si | 32.0 |
| Br | 27.0 | Hg | 19.0 | Sn | 42.3 |
| C | 14.8 | I | 37.0 | Ti | 35.7 |
| Cr | 27.4 | P | 27.0 | V | 32.0 |
| F | 8.7 | Pb | 48.3 | Zn | 20.4 |

| | |
|---|---|
| Cl, terminal, as in RCl | 21.6 |
| medial, as in R-CHCl-R | 24.6 |
| Nitrogen, double-bonded | 15.6 |
| triply bound, as in nitriles | 16.2[a] |
| in primary amines, $RNH_2$ | 10.5 |
| in secondary amines, $R_2NH$ | 12.0 |
| in tertiary amines, $R_3N$ | 10.8[b] |
| Oxygen, except as noted below | 7.4 |
| in methyl esters | 9.1 |
| in methyl ethers | 9.9 |
| in higher esters and ethers | 11.0 |
| in acids | 12.0 |
| in union with S, P, N | 8.3 |
| For 3-membered ring, as in ethylene oxide, deduct | 6.0 |
| For 4-membered ring, as in cyclobutane, deduct | 8.5 |
| For 5-membered ring, as in furan, thiophene, deduct | 11.5 |
| For 6-membered ring, as in benzene, cyclohexane, pyridine, deduct | 15.0 |
| For naphthalene ring, deduct | 30.0 |
| For anthracene ring, deduct | 47.5 |

[a] Determined by author from available data on five nitriles and cyanides.
[b] Determined by author from limited data on three tertiary amines.

*Estimating Molecular Volumes*—Molecular volumes for some simple substances are given in Table I.

For other substances we can calculate molecular volumes by Kopp's law of additive volumes, which states that the molecular volume is simply the sum of the atomic volumes. The values of LeBas[11] for atomic volumes (see Table II) are assigned to the elements in any particular substance and then summed.

Or we may calculate molecular volume directly if we know the density of the liquid at its normal boiling point, thus:

$$V = M/s_b \tag{2}$$

*Estimating Gas Density*—For the assumed concentration conditions of Case I—one component in low concentration—we can figure density and viscosity for only the gas present in large concentration, the "field" gas through which the other component diffuses.

We can calculate density via the gas law:

$$\rho = PM/(19.31zT) \tag{3}$$

where z is the compressibility factor. Since we are restricting ourselves to low or moderate pressure, z may be taken as unity.

*Estimating Gas Viscosity*—We run into a more complicated situation when we derive a method of estimating gas viscosity.

We start with Arnold's general relation[1] between liquid molecular volume and gas viscosity at the normal boiling point:

$$V = 0.0027\left[\frac{M^{0.5}T_b^{1.5}}{\mu_b(T_b + C)}\right]^{1.5} \tag{4}$$

where C is known as the Sutherland constant and, within a maximum error of ±10%, is equal[2, 16] to 1.47 $T_b$.*

Next is Sutherland's equation[14] for estimating the variation of gas viscosity with temperature:

$$\mu_2 = \mu_1\left(\frac{T_1 + C}{T_2 + C}\right)\left(\frac{T_2}{T_1}\right)^{1.5} \tag{5}$$

The fair validity of this relation over moderate temperature ranges has been established, and general use has been made of it in correlating the effect of temperature on the transport properties of gases at low pressure.

We can now solve Eq. (4) for viscosity at the normal boiling point and combine the result with Eq. (5) to get the general relation for gas viscosity:

$$\mu = \frac{0.00667M^{0.5}T^{1.5}}{V^{0.67}(T + 1.47T_b)} \tag{6}$$

The only restriction on this equation is that it is limited to low pressure. Of course we have to know the normal boiling point of the principal component.

Actually, the numerical coefficient in Eq. (6) comes out to be 0.00652 instead of 0.00667. However, if we compare vapor viscosities calculated by Eq. (6), using the lower value, with the accurate (±1%) experimental data of Craven and Lambert,[4] we find that we are about 2.3% low. The higher value of coefficient corrects for this deviation. Table III gives the comparison for 11 common organic vapors; average error is 5.7%.

*Final Correlation*—We are now able to combine the individual correlations for viscosity, density and diffusivity into an over-all correlation for Schmidt number:

$$N = \mu/\rho D = \frac{0.445TM_B^{0.5}(V_A^{0.33} + V_B^{0.33})^2}{(T + 1.47T_{bA})(M_A + M_B)^{0.5}V_A^{0.67}} \tag{7}$$

* Except for hydrogen, helium and deuterium, for which $C = 79$ K.

### NOMENCLATURE

| | |
|---|---|
| $C$ | Sutherland constant, deg. K. ($= 1.47T_b$) |
| $D$ | Molecular diffusivity of component in vapor phase, sq.ft./hr. |
| $M$ | Molecular weight, lb./lb.-mole |
| $N$ | Schmidt number, dimensionless |
| $P$ | Total system pressure, lb./sq. in. abs. |
| $P_c$ | Critical pressure, atm. abs. |
| $P_{pc}$ | Pseudocritical pressure, atm. abs. |
| $s$ | Liquid density, gm./cc. |
| $T$ | Absolute temperature, deg. K. |
| $T_c$ | Critical temperature, deg. K. |
| $T_{pc}$ | Pseudocritical temperature, deg. K. |
| $V$ | Molecular volume of liquid at normal boiling point, cc./gm.-mole |
| $y$ | Mole fraction of component in gas phase |

Here again we have adjusted the numerical coefficient from a calculated value of 0.515 to 0.445 in order to get better agreement with experimental data. As shown in Table IV, Eq. (7) gives an average deviation of 7.8% and a maximum deviation of 16% when compared with experimental data for 19 gases of widely different types in air.[18] The Sutherland constant for air, 1.47 $T_{bA}$, was taken as 120 K.

We have followed the convention of denoting the component in high concentration by subscript *A* and that in low concentration by subscript *B*. This is necessary since both viscosity and density are in the final equation for only the higher concentration gas in this case, whereas diffusivity is based on properties of both components.

We must remember that Eq. (7) has certain restrictions. It is for a binary system at low or moderate pressure with low concentration of one component. Temperature of the system should not exceed about 400 F., as *D* actually increases somewhat faster than the 1.5 power of *T*. Eq. (7) will thus give low values for the Schmidt number at high temperatures.*

Note that the Schmidt number is independent of pressure in the low and moderate pressure range, total system pressure having cancelled out in the derivation of Eq. (7). Note also that temperature effect is rather small; it can be determined from the following equation, obtained from Eq. (7):

$$N_2 = N_1\left(\frac{T_2}{T_1}\right)\left(\frac{T_1 + 1.47T_{bA}}{T_2 + 1.47T_{bA}}\right) \qquad (8)$$

## Case II

**Composition–Binary gas mixture of any composition (not necessarily dilute).**
**Temperature–400 F. maximum.**
**Pressure–Low or moderate.**

Since *D* is essentially independent of composition for binary mixtures, we can express the relation between Case I and Case II conditions as

$$N_{II} = N_{I}\mu_{II}\rho_{I}/\mu_{I}\rho_{II} \qquad (9)$$

* The relation of Hirschfelder, Bird and Spotz (ref. 8) for diffusivity in nonpolar gas pairs takes this effect into account, but use of their relation is more complex and requires the inclusion of several additional variables and tabulated functions. It is believed that the result given above will be sufficiently accurate for nearly all engineering calculations.

### Test of Eq. (6), Gas Viscosity—Table III

| Compound | Measured Viscosity [1] | Calculated Viscosity [2] | Calculated ÷Measured [3] |
|---|---|---|---|
| Ethane | 98.6 | 106.3 | 1.079 |
| Normal hexane | 73.2 | 66.5 | 0.908 |
| Cyclohexane | 75.8 | 71.8 | 0.947 |
| Benzene | 82.9 | 80.0 | 0.966 |
| Methyl chloride | 119.4 | 125.0 | 1.046 |
| Ethyl chloride | 105.0 | 102.0 | 0.972 |
| Methanol | 106.2 | 99.5 | 0.935 |
| Diethyl ether | 81.8 | 78.3 | 0.956 |
| Acetaldehyde | 93.8 | 101.5 | 1.081 |
| Acetone | 82.1 | 85.6 | 1.041 |
| Acetonitrile | 77.6 | 81.9 | 1.052 |

[1] From Ref. 4, at T = 323 K., P = 10-30 mm. Hg, viscosity in micropoises [2] From Eq. (4). [3] Average deviation = 5.7%, maximum deviation = 8.7%

### Test of Eq. (7), Schmidt Number—Table IV

(T = 273 K., P = 1 atm. abs.)

| System | Measured Schmidt No. [1] | Calculated Schmidt No. [2] | Calculated ÷Measured [3] |
|---|---|---|---|
| Water vapor-air | 0.603 | 0.659 | 1.092 |
| Normal octane-air | 2.621 | 2.225 | 0.849 |
| Toluene-air | 1.869 | 1.895 | 1.014 |
| Acetic acid-air | 1.245 | 1.370 | 1.10 |
| Ammonia-air | 0.615 | 0.719 | 1.169 |
| Benzene-air | 1.72 | 1.726 | 1.002 |
| Normal butanol-air | 1.882 | 1.661 | 0.883 |
| Carbon dioxide-air | 0.960 | 1.009 | 1.05 |
| Carbon disulfide-air | 1.484 | 1.402 | 0.945 |
| Ethyl acetate-air | 1.849 | 1.748 | 0.945 |
| Ethyl alcohol-air | 1.298 | 1.240 | 0.956 |
| Ethyl ether-air | 1.701 | 1.687 | 0.991 |
| Methyl acetate-air | 1.577 | 1.535 | 0.974 |
| Methyl alcohol-air | 0.998 | 0.968 | 0.97 |
| Oxygen-air | 0.745 | 0.855 | 1.147 |
| Naphthalene-air | 2.58 | 2.22 | 0.86 |
| Normal propyl acetate-air | 1.978 | 1.915 | 0.969 |
| Normal propyl alcohol-air | 1.557 | 1.460 | 0.937 |
| Hydrogen-air | 0.217 | 0.250 | 1.151 |

[1] Based on kinematic viscosity of dry air = 0.5142 sq. ft./hr., as per Hilsenrath and Touloukian (Ref. 7), rather than 0.512 used by Sherwood and Pigford. [2] From Eq. (7). [3] Average deviation = 7.8%, maximum deviation = 16%.

For Case II density all we need do is use a mean molecular weight in Eq. (3), replacing *M* with

$$M_m = y_A M_A + y_B M_B \qquad (10)$$

where y is mole fraction of each component.

We can compute viscosity of a mixture of two or more gases at low pressure in any one of several different ways. By far the simplest is that proposed by Maxwell:[12]

$$\mu_m = \frac{\Sigma_1^n \mu y M^{0.5}}{\Sigma_1^n y M^{0.5}} \qquad (11)$$

which, for two components, becomes

$$\mu_m = \frac{\mu_A y_A M_A^{0.5} + \mu_B y_B M_B^{0.5}}{y_A M_A^{0.5} + y_B M_B^{0.5}} \qquad (12)$$

By combining Eqs. (3), (6), (9), (10) and (12) we get:

$$N_{II} = \frac{N_I M_A^{0.5}[y_A M_A V_B^{0.67}(T+1.47T_{bB}) + y_B M_B V_A^{0.67}(T+1.47T_{bA})]}{V_B^{0.67}(y_A M_A + y_B M_B)(y_A M_A^{0.5} + y_B M_B^{0.5})(T+1.47T_{bB})} \qquad (13)$$

We see that correction for the effect of composition

| | |
|---|---|
| *z* | Compressibility factor, dimensionless |
| $\mu$ | Viscosity, lb./(hr.) (ft.) [except in cp. for Eq. (4)] |
| $\rho$ | Density, lb./cu. ft. |

Subscripts

| | |
|---|---|
| *A* | Component A (greater concentration) |
| *B* | Component B (lesser concentration) |
| *b* | At normal boiling point |
| *m* | Mixture value |
| 1 | At Temperature 1 |
| 2 | At Temperature 2 |
| *I* | For Case I conditions |
| *II* | For Case II conditions |

on viscosity considerably complicates the formal solution.

If you are accustomed to using pseudocritical conditions, you can combine the viscosity equation of Johnson, Huang and Kemp[9] with the other relations to yield, after suitable adjustment of the constant:

$$N = \frac{0.099 T^{0.28} P_{pc}^{0.67} (M_A M_B)^{0.5} (V_A^{0.33} + V_B^{0.33})^2}{T_{pc}(M_A + M_B)^{0.5}(y_A M_A + y_B M_B)^{0.5}} \quad (14)$$

where

$$P_{pc} = y_A P_{cA} + y_B P_{cB}$$
$$T_{pc} = y_A T_{cA} + y_B T_{cB}$$

If we include the mean compressibility factor $z_m$ in the numerator, we can use Eq. (14) to calculate Schmidt numbers for pressures up to about 30 atmospheres absolute or the pseudocritical pressure of the gas mixture, whichever is lower.

Which is the better equation to use, Eq. (13) or Eq. (14)? The choice is primarily dependent upon the data we have available. Eq. (14) is preferable if we have good critical data; its accuracy is equivalent to that of Eq. (7). Eq. (13) will be suitable if we know only structural formulas, boiling points and molecular weights. Any error in the constant in the viscosity ratio of Eq. (9) cancels out, and the accuracy should be close to that of Eq. (7).

## Case III

**Composition—Any number of components in any concentration.**

**Temperature—Any.**

**Pressure—Any.**

We can solve the general case only by calculating the three terms in the Schmidt number separately.

We calculate viscosities of each component by an equation such as Eq. (6), then combine these values by an equation such as Eq. (11), and finally convert to the given pressure by, for example, the Uyehara-Watson generalized viscosity chart[15] or one of its modifications.[8]

We can calculate gas mixture density by using a mean molecular weight and mean compressibility factor, getting the latter from any one of a number of standard compressibility charts by using $T_{pc}$ and $P_{pc}$.

We can calculate effective diffusivities for single components diffusing through a multicomponent mixture of stationary gases by means of a relation tested by Fairbanks and Wilke[5] in which appear the various binary diffusion coefficients involved. Data on effect of total pressure on $D$ are scanty but, as Sherwood and Pigford[13] point out, the product $DP$ appears to be substantially constant, in accordance with Eq. (1), up to $P$ of about 30 atmospheres total pressure.

Finally, we combine the three terms to get the desired Schmidt number.

## Sample Calculation

Kern, in "Process Heat Transfer,"[10] illustrates the design of cooler-condensers with a steam-carbon dioxide mixture.

Conditions are as follows:

Pressure: 30 psig.

Temperature in: 404.1 K.

Temperature out: 322.2 K.

Vapor in: 250 lb.-moles/hr. $H_2O$, 35 lb.-moles/hr. $CO_2$.

Vapor out: 1.37 lb.-moles/hr. $H_2O$, 35 lb.-moles/hr. $CO_2$.

Kern uses a constant average value of $N^{0.67} = 0.62$, or $N = 0.488$.

We could use Eqs. (13) or (14) with an average composition and temperature to calculate the mean Schmidt number of this system. But let's use the simple Eq. (7) so that we may clarify its applicability to many cases.

**Inlet Conditions**—The mixture is rich in steam, so subscript A therefore denotes $H_2O$. Substituting the proper values in Eq. (7) we get:

$$N = \frac{(0.445)(404.1)(44)^{0.5}[(18.85)^{0.33} + (34.0)^{0.33}]^2}{[404.1 + (1.47)(373.2)](18 + 44)^{0.5}(18.85)^{0.67}} = 0.78$$

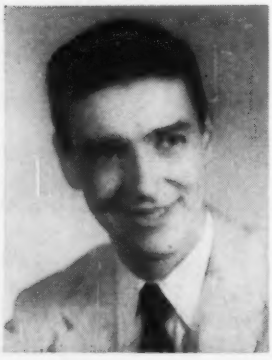
**Outlet Conditions**—Here the mixture is rich in $CO_2$, so we reverse our susbcripts to get:

$$N = \frac{(0.445)(322.2)(18)^{0.5}[(18.85)^{0.33} + (34.0)^{0.33}]^2}{[322.2 + (1.47)(351.7)](18 + 44)^{0.5}(34.0)^{0.67}} = 0.305$$

Employing the geometric mean of the inlet and outlet values, as is done in distillation with relative volatilities and absorption factors, we get:

$$N_{av.} = [(0.78)(0.305)]^{0.5} = 0.488$$

which agrees with Kern's value.



WALLACE R. GAMBILL has made a special study of methods for estimating the physical properties most often needed in chemical engineering calculations. He expects to publish the results of this study in book form next year.

Since graduation from Georgia Tech in 1952 he has been with the engineering department of Carbide & Carbon Chemicals Co., S. Charleston, W. Va.

REFERENCES

1. Arnold, J. H., *Ind. Eng. Chem.*, **22**, 1091 (1930).
2. Arnold, J. H., *J. Chem. Phys.*, **1**, 170 (1933).
3. Bromley, L. A., and Wilke, C. R., *Ind. Eng. Chem.*, **43**, 1641 (1951).
4. Craven, P. M., and Lambert, J. D., *Proc. Roy. Soc.*, Ser. A, **205**, 439 (1951).
5. Fairbanks, D. F., and Wilke, C. R., *Ind. Eng. Chem.*, **42**, 471 (1950).
6. Gilliland, E. R., *Ind. Eng. Chem.*, **26**, 681 (1934).
7. Hilsenrath, J., and Touloukian, Y. S., *Trans. ASME*, **76**, 967 (1954).
8. Hirschfelder, J. O., Bird, R. B., and Spotz, E. L., *Chem. Revs.*, **44**, 205 (1949); *J. Chem. Phys.*, **16**, 968 (1948); *Trans. ASME*, **71**, 921 (1949).
9. Johnson, A. I., Huang, C. J., and Kemp, J. D., *Chem. Eng.*, Dec. 1954, p. 195.
10. Kern, D. Q., "Process Heat Transfer," McGraw-Hill, New York, 1950, p. 346.
11. LeBas, "The Molecular Volumes of Liquid Chemical Compounds," Longmans, London, 1915.
12. Maxwell, J. B., "Data Book on Hydrocarbons," Van Nostrand, New York, 1950, p. 157.
13. Sherwood, T. K., and Pigford, R. L., "Absorption and Extraction," 2nd ed., McGraw-Hill, New York, 1952, pp. 20, 21.
14. Sutherland, *Phil. Mag.*, **38**, 1 (1894).
15. Uyehara, O. A., and Watson, K. M., *Natl. Petr. News, Tech. Sect.*, **36**, R764 (1944).
16. Vogel, *Ann. Physik.*, **43**, 1235 (1914).

CE REFRESHER

# Chemical Engineering Fundamentals

## Reactor Design Problem: Simple Reaction

**T. E. CORRIGAN and E. F. YOUNG, Olin Mathieson Chemical Corp., Brandenburg, Ky.**

Last month (*Chem. Eng.*, Nov. 1955, p. 217) we discussed some of the questions that a chemical engineer asks when he considers the design of a reactor for a simple reaction system. These were:

- What additional holding time, or reactor volume, would be needed to compensate for backmixing?
- For a reactor of given size, what would be the decrease in conversion caused by backmixing?

Another question which the chemical engineer must answer is:

- If a stirred tank reactor originally designed for batch operation were converted to continuous operation, what would be the conversion when the same holding time is maintained?

We'll try to answer this question now. And we'll conclude this section on the general consideration of reactor design by working out a design problem for a simple reaction with backmixing present.

### Backmixing and Conversion at Constant Volume

We have already considered the effect of backmixing on the second-order reaction

$$A + B \rightarrow R + S$$

In a batch or a longitudinal flow reactor, we saw that

$$\frac{1}{a-b} \ln \frac{b(a-x)}{a(b-x)} = kt$$

when the initial charge of $A$ does not equal the initial charge of $B$.

In a steady-state backmixing reactor,

$$kt_b = x_b/[(a - x_b)(b - x_b)]$$

These two equations, in terms of holding times, are too complex to be solved explicitly for $x$. And so a ratio of $x_b$ to $x$ would be difficult to express in equation form —except for the case of equimolal feeds.

However, the equations can be solved numerically and the results tabulated and plotted (as we will do in working out the sample design problem below).

To illustrate the effect of backmixing on conversion at constant reactor volume, we have worked out a sample case. Let's consider the second-order reaction

$$A + B \rightarrow R + S$$

and assume that the feed to the reactor is a 1-to-1 mole ratio of $A$ to $B$. Fig. 1 compares the expected conversions in backmixing and longitudinal flow reactors of the same volume (see p. 212).

As ordinate we plot the ratio of $x_b/x$, which is the conversion in a 100% backmixed reactor divided by the conversion in a longitudinal flow reactor. The abscissa is $x$, the conversion in a longitudinal flow reactor.

You can see from Fig. 1 that the ratio $x_b/x$ passes through a minimum value. This seems logical when you consider the fact that $t$ or $(V/F)$ approaches infinity as either $x$ or $x_b$ approaches 1.0

### Considering Backmixing in Reactor Selection

The effect of backmixing is an important factor in selecting the type of reactor to use. This is apparent from our discussion last month (*Chem. Eng.*, Nov. 1955, p. 219) and above.

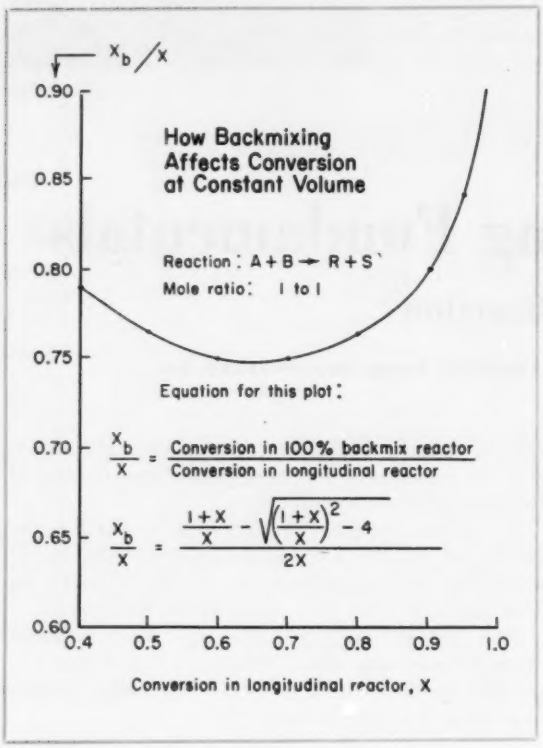
If the desired conversion is 90 to 95% or above, at least ten times the reactor volume is required when a stirred tank is used instead of a tubular reactor. Baffled tanks and packed towers fall somewhere between the two extremes of the longitudinal flow reactor and the stirred tank.

Why, then, are there ever anything but long tubular reactors used?

One reason may be that in many cases the important effect of backmixing has been overlooked in the selection of the type of reactor to use. There may be many

### Nomenclature (Consistent Units)

| | |
|---|---|
| $a, b$ | Initial charge of $A$, $B$ in concentration units |
| $A, B$ | Reactants |
| $C_{A_0}$ | Initial concentration of $A$ |
| $D$ | Diameter |
| $F$ | Feed rate |
| $k$ | Rate constant |
| $L$ | Length |
| $M$ | Molar ratio |
| $R, S$ | Products |
| $t$ | Holding time in a batch or longitudinal flow reactor |
| $t_b$ | Holding time in a backmix reactor |
| $V$ | Volume |
| $x$ | Degree of conversion in a batch or longitudinal flow reactor |
| $x_b$ | Degree of conversion in a backmix reactor |




stirred tanks in use today where a long tubular reactor could do a much better job.

Another—and undoubtedly more probable—reason is that in general a stirred tank, packed tower or baffled tank costs much less per unit of volume than a tubular reactor.

In his preliminary calculations prior to reactor selection the chemical engineer can size the reactor for two extreme cases—longitudinal flow and complete backmixing. Then he knows that any reactor will fall within these limits.

He can assume with a fair degree of certainty that a small diameter pipe will fall at one extreme and a stirred tank at the other. Unfortunately, there is no exact way to evaluate other types of reactors (packed towers, large diameter pipes, baffled tanks) except by using an empirical "backmix factor."

Such factors are not generally available in the literature although they may possibly be available in the private design files of some companies. The determination and correlation of backmix factors for towers, tanks and pipes of various $L/D$ ratios would be a valuable contribution to chemical engineering literature. And it would make an interesting subject for an M.S. or Ph. D. thesis.

## A Reactor Design Problem . . .

We'd like to illustrate some of the principles of how backmixing affects reactor size by working out a complete reactor design problem. Suppose we want to design a process for manufacturing the compound $R$ which can be produced in the single reaction

$$A + B \rightarrow R + S$$

Desired production capacity for the single reactor is to be 8,000,000 lb. of $R$ per year.

The first thing to decide is what kind of reactor to use. Then we'll want to know the most economical size of reactor. Here are some data and notes:

- The cost of reactants are: $A = 1.5¢$/lb.; and $B = 0.1¢$/lb.
- The molecular weights of the products and reactants are: $A = 40$; $B = 80$; $R = 60$; and $S = 60$.
- All four materials have the same density, 8.0 lb./gal.
- The reaction rate constant has been determined experimentally and has been evaluated as: $k = 75$ gal./lb. mole-hr. at the average temperature at which the reactor will be operated.
- The compounds $A$ and $S$ form an inseparable azeotrope so that $A$ cannot be recycled.
- An operating factor equivalent to 8,000 hr./yr. can be used.
- The economics of the process in the preliminary study will be based on a simple three-year payout period.
- The relative volatilities of the materials are in this order:

$$S \lesseqgtr A > R > B$$

Therefore, compound $B$ shows up in the bottoms of the last distillation column. To clean it up for recycle would require another column. It can be assumed that the cost of recycling $B$ is equivalent to the cost of fresh $B$; so that our reactor design is independent of the decision as to whether or not $B$ is recycled.

## . . . and Its Solution

First step in solving this problem is to sketch up a rough flowsheet of the proposed process. We have done this on p. 213. Here the reactor is represented by a blank box because we have not yet selected the type of reactor.

Pure reactants $A$ and $B$ feed the reactor. $A$ cannot be recycled, as mentioned above, because it is irrecoverable from the $A$-$S$ mixture. $B$ can be recycled if desired.

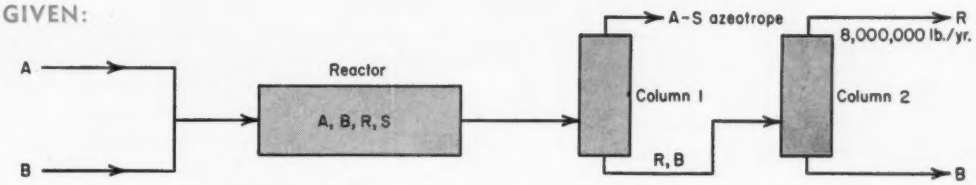
The reactor effluent containing $A$, $B$, $R$ and $S$ feeds Column 1 where the $A$-$S$ azeotrope goes overhead and a mixture of $R$ and $B$ make up the bottoms. The total number of plates will not vary greatly with the composition of the feed and, therefore, we shall assume that it is constant for this problem.

Since the required diameter of a distillation column is much more sensitive to vapor loading than to liquid loading, the diameter will be fixed by the quantity of overhead vapors. Also, since the overhead is the $A$-$S$ azeotrope, the column diameter will remain constant for a given amount of $A$ in the feed and will be relatively independent of the amount of $B$ fed.

The bottoms from Column 1 feed Column 2. The desired product, $R$, is the overhead and $B$ is the bot-

## Select a Reactor for Performing a Simple Reaction

GIVEN:




FIND: The most economical reactor.

CALCULATIONS:

**Longitudinal Flow Reactors**

| Conversion, % | Mole Ratio, B to A | Lb./Hr. of A | Lb./Hr. of B | Holding Time, Hr. | Reactor Volume, Gal. | Reactor Cost, $ | Reactant Cost, $/Hr. | Reactor Cost, $/Hr. | Total Cost, $/Hr. |
|---|---|---|---|---|---|---|---|---|---|
| 90 | 1.0 | 742 | 1,484 | 1.8 | 501 | 75,800 | 12.61 | 3.16 | 15.77 |
| 90 | 1.5 | 742 | 2,226 | 0.74 | 275 | 40,800 | 13.36 | 1.70 | 15.06 |
| 90 | 2.0 | 742 | 2,968 | 0.568 | 264 | 40,000 | 14.10 | 1.67 | 15.77 |
| 90 | 2.5 | 742 | 3,710 | 0.494 | 275 | 41,600 | 14.84 | 1.74 | 16.58 |
| 90 | 3.0 | 742 | 4,452 | 0.454 | 295 | 44,300 | 15.58 | 1.85 | 17.43 |
| 95 | 1.0 | 702 | 1,404 | 3.8 | 1,000 | 15,200 | 11.93 | 6.30 | 18.23 |
| 95 | 1.5 | 702 | 2,106 | 1.06 | 372 | 56,400 | 12.64 | 2.35 | 14.99 |
| 95 | 2.0 | 702 | 2,808 | 0.785 | 329 | 49,800 | 13.38 | 2.07 | 15.45 |
| 95 | 2.5 | 702 | 3,510 | 0.671 | 354 | 53,600 | 14.04 | 2.22 | 16.26 |
| 95 | 3.0 | 702 | 4,212 | 0.594 | 365 | 55,200 | 14.74 | 2.30 | 17.04 |
| 98 | 1.0 | 681 | 1,362 | 9.8 | 2,500 | 388,000 | 11.58 | 15.74 | 27.32 |
| 98 | 1.5 | 681 | 2,043 | 1.52 | 520 | 78,600 | 12.26 | 3.20 | 15.52 |
| 98 | 2.0 | 681 | 2,724 | 1.08 | 460 | 69,600 | 12.94 | 2.90 | 15.84 |
| 98 | 2.5 | 681 | 3,405 | 0.91 | 465 | 66,600 | 13.62 | 2.90 | 16.52 |
| 98 | 3.0 | 681 | 4,086 | 0.82 | 490 | 74,200 | 14.30 | 3.10 | 17.40 |

**Backmix Reactors**

| Conversion, % | Mole Ratio, B to A | Lb./Hr. of A | Lb./Hr. of B | Reactor Volume, Gal. | Reactor Cost, $ | Reactant Cost, $/Hr. | Reactor Cost, $/Hr. | Total Cost, $/Hr. |
|---|---|---|---|---|---|---|---|---|
| 90 | 1.0 | 742 | 1,484 | 7,500 | 78,700 | 12.61 | 3.28 | 15.89 |
| 90 | 1.5 | 742 | 2,226 | 2,220 | 38,000 | 13.36 | 1.58 | 14.94 |
| 90 | 2.0 | 742 | 2,968 | 1,890 | 35,000 | 14.10 | 1.46 | 15.56 |
| 90 | 2.5 | 742 | 3,710 | 1,875 | 35,000 | 14.84 | 1.46 | 16.30 |
| 90 | 3.0 | 742 | 4,452 | 1,950 | 35,000 | 15.58 | 1.46 | 17.04 |
| 95 | 1.0 | 702 | 1,404 | 30,000 | 181,000 | 11.93 | 7.55 | 19.48 |
| 95 | 1.5 | 702 | 2,106 | 5,910 | 64,000 | 12.64 | 2.87 | 15.50 |
| 95 | 2.0 | 702 | 2,808 | 3,960 | 54,000 | 13.38 | 2.25 | 15.58 |
| 95 | 2.5 | 702 | 3,510 | 3,870 | 54,000 | 14.04 | 2.25 | 16.29 |
| 95 | 3.0 | 702 | 4,212 | 3,980 | 54,000 | 14.74 | 2.25 | 16.99 |

SOLUTION: The preferred reactor would be one that allows for backmixing. Gives a 90% conversion from a 1.5-to-1 mole ratio feed of B to A.

toms. Therefore, the height and diameter of this column will be dependent on the amount of *R* fed but will be relatively independent of the amount of *B*.

We can see from this discussion that the column costs will be constant for just about all cases of conversion and mole ratio of A to *B* that we can consider. And so we can neglect the column costs in our solution to this problem.

Then, the problem becomes one of balancing the reactant cost and the reactor costs so as to obtain a minimum total cost. We conclude from this that a high conversion of A is desirable.

### How to Approach the Problem

The method of approaching this problem will be to determine the reactor cost plus reactant cost for several cases. Then we will select the case of lowest

total cost. Both longitudinal flow and backmix reactors will be considered.

For our first case let's consider a longitudinal reactor in which the conversion is 95% from an equimolal feed of A and B. The integral rate equation for equal molal feed is:

$$x/(1-x) = kC_{A_0}t$$

$$\text{Lb. of } R/\text{hr.} = \frac{8{,}000{,}000 \text{ lb./yr.}}{8{,}000 \text{ hr./yr.}} = 1{,}000 \text{ lb./hr.}$$

$$1{,}000/60 = 166.7 \text{ lb.-moles of } R/\text{hr.}$$

Now we can write a material balance equation:

| 667 lb. | | 1,333 lb. | | 1,000 lb. | | 1,000 lb. |
|---|---|---|---|---|---|---|
| $A$ | + | $B$ | → | $R$ | + | $S$ |
| 40 | | 80 | | 60 | | 60 |

At 95% conversion,

$$A = 667/0.95 = 702 \text{ lb./hr.}$$
$$B = 1{,}333/0.95 = 1{,}404 \text{ lb./hr.}$$
$$\text{Total reactor charge} = 2{,}106 \text{ lb./hr.}$$

Now, to suit our convenience, we can convert the reactor charge in lb./hr. to gal./hr.

$$2{,}106 \text{ lb./hr.} \div 8 \text{ lb./gal.} = 263 \text{ gal./hr.}$$

$$C_{A_0} = \frac{702 \text{ lb./hr.}}{40 \text{ lb./lb.-mole} \times 263 \text{ gal./hr.}} = 0.0667 \frac{\text{lb.-moles}}{\text{gal.}}$$

This gives us the values of all the unknowns in the holding time equation. Solving,

$$t = x/(1-x)kC_{A_0}$$

$$t = \frac{0.95}{(1-0.95)(75 \text{ gal./lb. mole-hr.})(0.0667 \text{ lb.-moles/gal.})}$$

$$t = 3.8 \text{ hr.}$$

$$V = 263 \text{ gal./hr.} \times 3.8 \text{ hr.} = 1{,}000 \text{ gal.}$$

As a second case we'll solve for the volume of a longitudinal reactor with nonequimolal feed. The feed rate of A will be the same, 702 lb./hr., but we will now feed 2 moles of B per mole of A; that is, $M = 2$. Expected conversion will again be 95%. The integral equation is:

$$kC_{A_0}t = \frac{1}{M-1} \ln \frac{1}{M}\left(\frac{M-x}{1-x}\right)$$

If A is 702 lb./hr., then

$$B = 2 \text{ lb.-moles/lb.-mole of } A = 2{,}808 \text{ lb./hr.}$$
$$\text{Total feed} = 3{,}510 \text{ lb./hr.}$$
$$= 439 \text{ gal./hr.}$$

$$C_{A_0} = \frac{702 \text{ lb./hr.}}{40 \text{ lb./lb.-mole} \times 439 \text{ gal./hr.}}$$

$$C_{A_0} = 0.400 \text{ lb.-moles/gal.}$$

$$t = \frac{\frac{1}{2-1} \ln \frac{1}{2}\left(\frac{1.05}{0.05}\right)}{(75)(0.0400)} = 0.79 \text{ hr.}$$

$$V = 439 \text{ gal./hr.} \times 0.79 \text{ hr.} = 329 \text{ gal.}$$

As our third case we'll consider a reactor with backmixing. Here,

$$V = \frac{\text{lb.-moles of } R \text{ produced}}{kC_{A_0}^2(1-x)(M-x)}$$

$$M = 2 \qquad x = 0.95$$

$$V = \frac{1{,}000/60}{75(0.0400)^2(0.05)(1.05)} = 3{,}960 \text{ gal.}$$

### How We Can Estimate the Costs

For the longitudinal reactor we will base our design on the calculated volumes in terms of standard pipe. Costs can be estimated by the usual chemical engineering cost techniques.*

The simple three-year payout can best be calculated by assuming that the equipment cost is evenly divided over three years. Therefore, the reactor cost per hour is simply the total investment required divided by the number of hours operated in three years.

### A Typical Cost Calculation

To illustrate the order of magnitude of the values, we'll work out below a typical cost calculation for this problem.

Material Cost
681 lb. of $A$/hr. at 1.5¢/lb. = $10.22
2,043 lb. of $B$/hr. at 0.1¢/lb. = 2.04
Total = $12.26/hr.

Reactor Cost
3 yr. payout = 24,000 operating hours
Total cost/Hours to payout = Cost per hour
$39,300/24,000 hr. = $1.63/hr.

Total Cost = Material Cost + Reactor Cost
= $12.26/hr. + $1.63/hr.
= $13.89/hr.

In the table on p. 213 we show the results of cost estimates for 25 possible solutions to this problem. The three best answers are:

- A backmix reactor, 90% conversion with a 1.5-to-1 mole ratio.
- A longitudinal reactor, 90% conversion with a 1.5-to-1 mole ratio.
- A longitudinal reactor, 95% conversion with a 1.5-to-1 mole ratio.

Of these three answers the first is preferred because it involves less capital investment.

*A description of cost estimation techniques is beyond the scope of the CE Refresher series. However, if you'd like to brush up on them, we recommend these recent compilations:

1. "Data and Methods for Cost Estimation, A Collection of Articles from Chemical Engineering," Parts 1, 2 and 3 available as Reprints No. 2, 3 and 48.
2. "Chemical Engineering Cost Estimation," by R. S. Aries and R. D. Newton, McGraw-Hill Book Co., Inc., New York (1955).
3. "Process Engineering Economics," by H. E. Schweyer, McGraw-Hill Book Co., Inc., New York (1955).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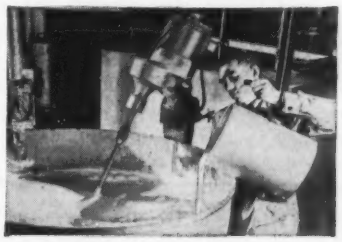

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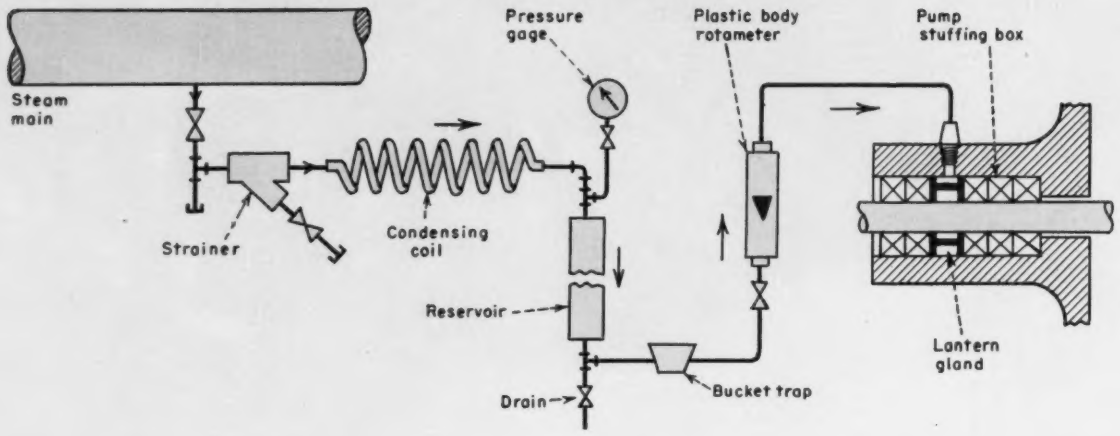



★ **Winner of September Contest**

# Condensate Provides Pump Seal Liquid

**Edward J. Gibbons and James Ulrich**

*Research & Development Dept., Colgate-Palmolive Co., Jersey City, N. J.*

There are many installations of centrifugal pumps, positive displacement pumps, turbine pumps and others with rotating shafts that could be improved by water lubrication, force-fed to the lantern ring of the stuffing box. Due to the low feed rate of water (usually about 10 cc. per min.), and the high pressure needed, an auxiliary pump is indicated. However, its cost, space requirement and the extra problems it presents usually prevent its use.

We solved this problem by using condensed steam fed to the lantern ring under the influence of the steam pressure. This gave a clean, reliable and easily controlled source of water pressure high enough to overcome the pump pressure and perform its lubricating function properly.

Equipment needed consists of a radiation coil of ¾-in. diam. copper tubing, long enough to condense 1.5 lb. of steam per hr.; a 3-in. diam. steel pipe 30 in. long to act as a reservoir; a small steam trap to prevent steam from blowing out in the event of a bad leak; a small, inexpensive plastic rotameter; and some miscellaneous pipe fittings and pipe.

Operation of this equipment is simple. The steam valve is turned on and condensation starts to fill the reservoir. After 5 min. the rotameter valve can be adjusted to give the required feed. Since the upstream pressure is always equal to the steam pressure and is constant, little attention is needed after that.

This system is economical to install, it can be placed high up and remote from the pump, is dependable, provides sterile water if necessary and overcomes objections to using city water. A more elaborate system would be to replace the coil with a small heat exchanger which could be manifolded to several units.

---

★ **Winner of October Contest:**

**When Pipes Freeze, Try These Effective Ways of Using Electric Thawing**

As winner of the October Plant Notebook Contest, this article has earned a prize of $50 in cash for Paul C. Ziemke, safety and maintenance engineer, Oak Ridge, Tenn. Doubtless you have heard of electric heat for pipe thawing. Here are several safe, quick and effective ways of doing it.

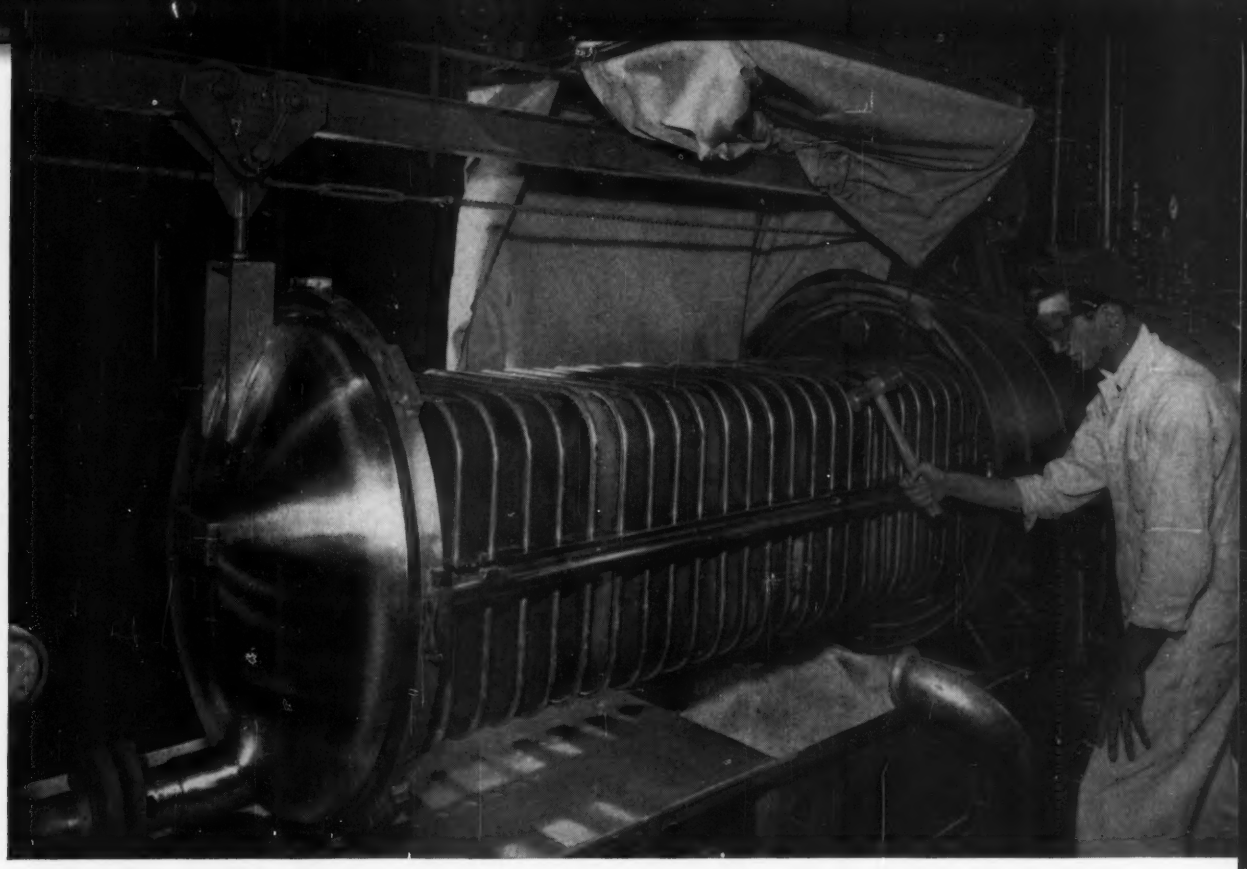
**$50 PRIZE FOR A GOOD IDEA**—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for the Plant Notebook.

Each month's winner will be announced in the issue of the second following month, and published the third following month.

**$100 ANNUAL PRIZE**—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article which will then be awarded an additional $100 prize.

**HOW TO ENTER CONTEST**—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable nonwinning articles will be published at regular space rates ($10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.



# How Norwich Pharmacal solved a separation problem

## *in the production of Nitrofurans*

**PROBLEM:** Furazolidone is a nitrofuran widely used in veterinary medicine, for the control of poultry diseases. In the synthesis of furazolidone, one of the final steps involves filtering the product from the suspension. The slurry is corrosive to carbon steel. After filtration, the cake must be washed with water, then partially dried and quickly removed so it can be fed to a tray dryer.

**SOLUTION:** For this step Norwich Pharmacal engineers specified a Niagara Horizontal Pressure Leaf Filter with 245 square feet of surface area; type 316 stainless steel at all liquid contact points; fitted with a low-pressure steam jacket. It is equipped with a special manifold at the top for blowing in hot air.

**RESULTS:** Entirely satisfactory. After the furazolidone collects on the filter leaves, it is washed with water, then partially dried inside the filter with hot air at 80° C. The leaves then roll out of the filter tank on a monorail and the semi-dry cake drops off the leaves into a cart, ready for feeding to the tray-dryer. Only a few minutes are required for one man to clean the filter and ready it for the next cycle.

Niagara stands ready to cooperate with you, too, in solving *your* problems. A Niagara field engineer will gladly run preliminary tests on your material, using a laboratory size filter. Should you decide to run production scale tests in your own plant, Niagara pilot filters are available to you. Niagara engineers will design and build filters to meet your specific needs. If you wish, your installation and start-up will be supervised by an experienced Niagara engineer.

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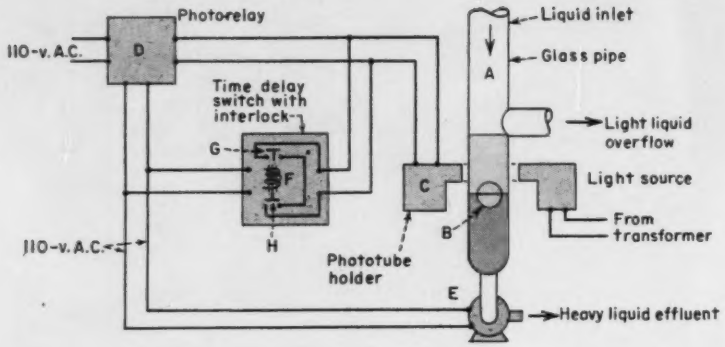



# Photocell Controls Interface Level

**R. L. Grantom and A. A. Feerick**

*Lion Oil Co., El Dorado, Ark.*

A rather simple but effective level controller, capable of controlling at the interface of two immiscible liquids in a glass column, can be assembled using a standard photorelay and time-delay switch. Advantages of the system are its relative simplicity and the fact that it can be used without probes or seals through the walls of the vessel.

Its operation depends upon a ball floating on the surface of the heavier liquid, that is, at the interface of two liquids. When the ball breaks the light beam to a photorelay, the relay energizes the pump which withdraws the heavier liquid from the column. At the same time the photorelay energizes the coil of a time-delay switch. This time-delay switch has a normally open, instantaneously acting interlock section which is connected in series with a normally closed, time-delay contact. The two series-connected contacts are connected in parallel with the phototube of the photorelay.

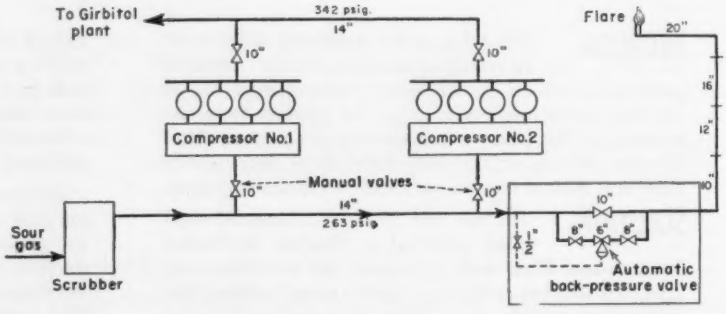
A typical operating cycle is as follows: The mixed liquids enter the top of the glass column *A* and separate into two layers, light and heavy. Floating ball *B* has a density such that it sinks through the light layer and floats on the heavy layer. Thus, it rises with the interface until it interrupts the light beam, striking the photocell in phototube holder *C*. This activates photorelay *D* which energizes both the pump *E* and the time-delay switch *F*.

Upon energizing the time-delay coil, interlock contact *G*, which is normally open, closes immediately thereby shorting out the phototube in *C* through the normally closed time-delay contact H. This allows the pump *E* to continue to run for the time required to lower the ball to the desired level. Then, time-delay contact *H* opens, which deactivates the photorelay, shuts off the pump, and allows the phototube to again control the photorelay. The controller is then ready for another cycle.

It is sometimes advisable, if the starting current of the pump motor is high, to let the photorelay activate a normally open mercury relay which in turn starts the pump. This reduces the wear on the contacts of the photorelay caused by arcing.

Satisfactory standard units for use in assembling the controller include: a General Electric photoelectric relay CR-7505-K100G3, complete with light-source, light-source transformer, and phototube holder for remote location of the phototube; and a Square D Type RO-10E normally closed, pneumatic time-delay switch with one interlock. With these units the period of pump operation can be varied from 0.2 sec. to as much as 3 min.

The unit described has operated continuously with no trouble for considerable lengths of time.




# Back-Pressure Control for Compressors

**Ismael Rodriguez L. and Thomas Garcia B.***

*Petroleos Mexicanos, Poza Rica, Ver., Mexico.*

Sour gas for our sulfur recovery plant comes from five gas gathering systems. After passing through a scrubber system the gas at 263 psig. is compressed to 342 psig. by means of two 800 bhp. Clark Bros. compressors, each handling 40 million scfd. The combined streams then

*Present address, Rice Institute, Houston, Tex.

# How Norwich Pharmacal solved a separation problem

## *in the production of Nitrofurans*

**PROBLEM:** Nitrofurazone is a nitrofuran used in the treatment of surface infections in wounds, burns and surgery. In the synthesis of nitrofurazone, one of the final steps involves separating out the precipitate, a fine-grained material which does not drain readily. The slurry is corrosive to stainless steel. After separation, the product must be washed to remove acids. The product is valuable so loss must be avoided.

**SOLUTION:** For this step Norwich Pharmacal engineers specified a 30″ Tolhurst Center-Slung® Centrifugal with rubber-lined case and rubber-covered basket, 2-speed explosion-proof motor and fume-tight cover with feed and spray pipes. A filter bag is used.

**RESULTS:** Entirely satisfactory. Slurry is fed at low speed to facilitate drainage. High speed is used for extracting. After centrifuging, the nitrofurazone is washed (at low speed) with treated water introduced through the spray pipe. The slurry does not affect the rubber lining. The filter bag inside the basket prevents loss of product.

Tolhurst engineers stand ready to cooperate with you, too, in solving *your* problems. Samples of the material you wish to process will be tested without charge in Tolhurst's laboratory. Tolhurst engineers will design and build centrifugal equipment to meet your specific needs. If you wish, your installation and start-up will be supervised by an experienced Tolhurst engineer. Field and home office engineers are always at your service.

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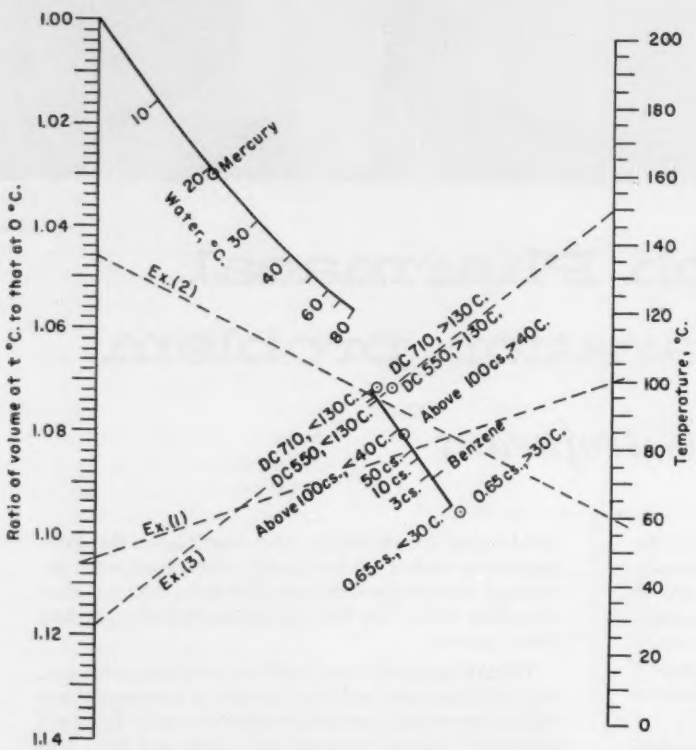
Specialists in Liquid–Solids Separation

flow to a Girbotol MEA stripping plant.

Trouble was encountered with variations in the gas supply pressure which would translate themselves into pressure variations at the compressor discharge and so give uneven gas flow to the MEA stripping plant. This in turn led to trouble in the $CO_2$ and $H_2S$ absorption columns.

The gathering systems were controlled with their own pressure-regulating valves, but starting or stopping of a compressor led to wide suction pressure variations, and maintenance of the regulating valves also was difficult. We attempted to correct the situation with the manually operated valves in the compressor suction lines, but pressure variations were still considerable.

The final solution to the problem was simple, consisting in the addition of an automatic back-pressure valve in the flare line, which readily held the suction pressure of the compressors at the desired 263 psig.




# Temperature-Volume Chart for Silicones

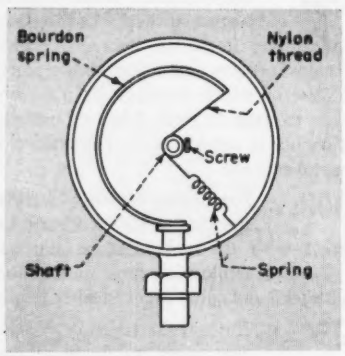
**F. P. Lingamfelter and D. S. Davis**

*Respectively, Norfolk, Va., and Virginia Polytechnic Institute, Blacksburg, Va.*

Present industrial prominence of silicones prompted the construction of the accompanying line coordinate chart which deals with the effect of temperature on the volume of liquid dimethyl silicones. On the nomograph these compounds are identified by their kinematic viscosities or by their Dow-Corning numbers. For some of the silicones double gage points are provided to take care of temperatures above and below 30 C., 40 C., and 130 C. An auxiliary scale for water, together with gage points for benzene and mercury, enable suitable comparisons to be made.

Use of the chart, which is based on data given by McGregor ("Silicones and Their Uses," page 55, McGraw-Hill Book Co., New York, 1954), is illustrated as follows: For dimethyl silicone of a viscosity of 50 centistokes, what is the ratio of the volume at 100 C. to that at 0 C.? Following the broken line for Example (1), connect 100 on the vertical temperature scale with the point for 50 cs. and read the desired ratio at the left as 1.105.

For Dow-Corning 550 silicone, what is the ratio of the volume at 60 C. to that at 0 C.? Since 60 C. is less than 130 C., align the point labeled "DC 550, < 130 C." with 60 on the vertical temperature scale (Ex. 2) and read the ratio of volumes as 1.046. For the same silicone, what is the ratio of the volume at 150 C. to that at 0 C.? Since 150 C. is greater than 130 C., connect 150 on the vertical temperature scale and the circled gage point labeled "DC 550, > 130 C." with the straight line marked Ex. (3) and read the ratio of volumes as 1.119. When the chart is used for water, equal values on the two temperature scales should be aligned.



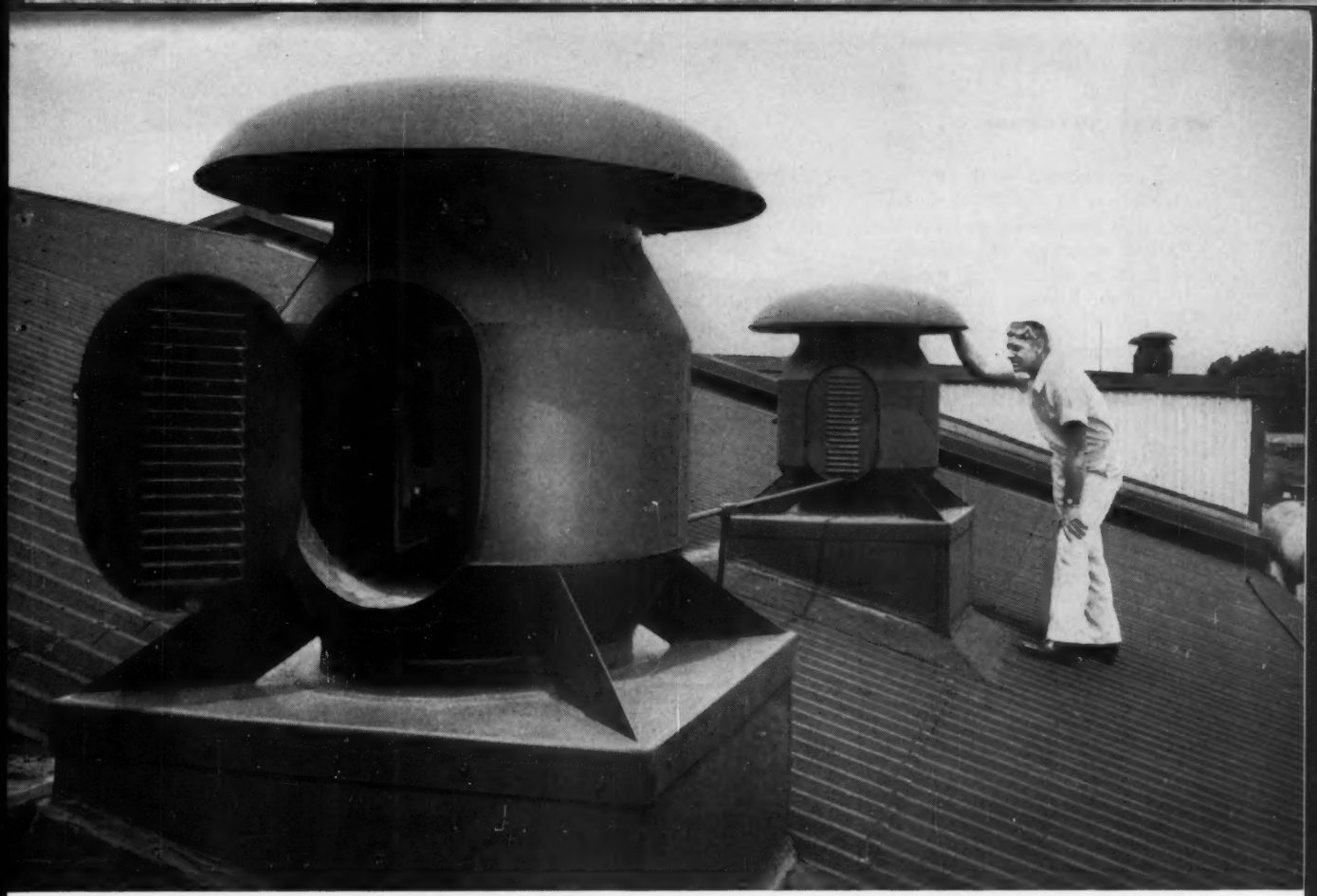

## Simple Repair for Bourdon Tube Gages

**Massimo Rosicarelli**

*Engineer, Saici-Torviscosa, Italy.*

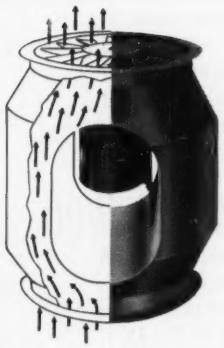
When the pinion and gear-sector movement of a Bourdon-tube pres-

Specialists in Liquid-Solids Separation



# CHAMBER PROTECTS MOTOR FROM FUMES

## . . . *minimizes fan maintenance*



The Bifurcator Roof Ventilator shields its fan motor from the destructive rush of hot or corrosive fumes. Note how the unit is built into a split housing and how the motor is mounted safely in its through-ventilated chamber. Destructive fumes bypass the chamber, leaving the motor unharmed. So there's never any need to replace fume-damaged motor parts or wiring. What's more, the motor always stays clean. It's easy to inspect . . . easy to get at for routine service. Just open the louver panel and there's the motor in its roomy chamber.

Installation costs are lower, too. The compact Bifurcator unit comes fully assembled . . . is installed in one piece. It's designed for easy roof curb mounting. No special platforms or supports. Furthermore, the Bifurcator can be used with or without a duct system. It can be furnished of, or coated with, corrosion-resistant materials. Fan wheels up to 48" in diameter. Send for new bulletin.

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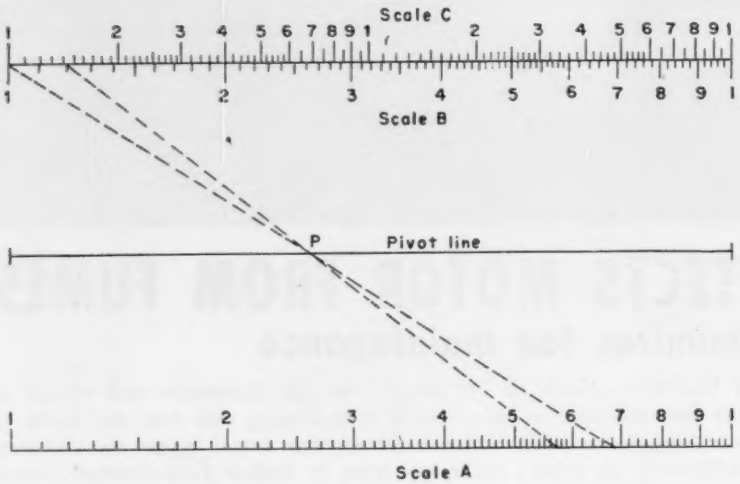
sure gage becomes worn, there is a simple way to repair the damage which is inexpensive and has the further advantage of eliminating backlash in transmitting the motion of the Bourdon spring to the pointer.

The scheme involves winding a nylon thread around the pointer shaft for several turns, attaching one end of the thread to the free end of the Bourdon tube and the other end to a small spring secured to the case to keep the thread taut. The damaged pinion and sector can be removed to make room for the new transmission. The thread can be secured to the pointer shaft by means of a small screw which will prevent slipping on the shaft.

The only tricky feature of this repair is to preserve the original calibration if possible by choosing the pointer shaft diameter so that the multiplication of the new movement will be the same as that of the original transmission. The multiplication factor of the original pinion and sector can be calculated and matched by a suitable shaft diameter. Or, it may be necessary or desirable to change the calibration and re-calibrate the instrument dial.




# Simple Chart Solves Cubic Equations

**Joseph T. Hogan**

*Chemical Engineer, New Orleans, La.*

In many engineering problems the algebraic solution of cubic equations is a necessary part of the numerical computation. Several authors [1,2,3,4] have published methods of approximate solution which employ special charts or the slide rule, but in spite of this it seems appropriate to call attention to still another method.

The general cubic equation $x^3 + ax^2 + bx + c = 0$, where a is not equal to zero, may be transformed to another equation without an $x^2$ term by substituting for x the term $(x_1 - a/3)$. This reduces the general cubic equation to the form $x_1^3 = Ax_1 + B$. Transferring $B$ to the left of the equation and dividing by $x_1$ gives the form $x_1^2 - B/x_1 = A$. Numerical solution of this last equation by means of the accompanying chart is one of trial and error. However, limiting values can be determined so as to make only a few trials necessary.

Consider the equation $x^3 = 75x + 690$ which can be transformed to $x^2 - 690/x = 75$. Inspection shows that $x$ must be greater than $75^{1/2}$ approximately, or a negative value will result. It is therefore not necessary to try values for $x$ less than 9. Further inspection shows that for $x = 15$ the lefthand side of the equation is greater than 75. Thus $x$ is some value between 9 and 15.

After the limiting values have been determined, the chart is used to determine the correct value of $x$ by trial and error. (After use of the chart is described later, its use in establishing the limits will be apparent).

For example, let's try the mean of 9 and 15, or $x = 12$. With a straightedge, connect 1 on Scale $B$ with 690 on Scale $A$, intersecting and marking the Pivot Line at point $P$. The straightedge, pivoted about point P and intersecting 12 on Scale $B$, intersects Scale $A$ at 57.5. Therefore, the numerical value of the term $690/x$ or $690/12$ in our sample equation equals 57.5. The relation of Scale $C$ to Scale $B$ defines the value of $x^2 = (12)^2 = 144$ on Scale $C$. Thus $144 - 57.5 = 86.5$. Obviously, $x = 12$ is too high, so let's try $x = 11.5$.

Repeating the procedure outlined above for using the chart, we find that $690/11.5 = 60$ and $x^2 = (11.5)^2 = 132$. Thus $132 - 60 = 72$. This value is quite close to the correct one. The next logical value to try is one slightly greater than 11.5. Further trials show that 11.6 is the approximate answer.

Use of the chart is simple and enables the user quickly to determine the numerical values of both terms in the equation $x^2 - B/x = A$ for any selected value of $x$. A simple subtraction gives the value of $A$. It will be noted that Scales $A$, $B$ and $C$ are similar to the $D$, $C$ and $B$ scales of the ordinary slide rule. The rules for determining the decimal point apply to these scales just as they do with the slide rule.

REFERENCES

1. Boswell, L. D., "Solving Cubic Equations on the Slide Rule," Oklahoma A. and M. College, Publication No. 28, Engineering Experiment Station (1935).
2. Dehn, E., "Algebraic Charts," Nomographic Press, New York (1930).
3. Running, T. R., "Graphical Mathematics," John Wiley and Sons, Inc., New York (1927).
4. Wylie, C. R., Jr., "A New Nomographic Treatment of the Cubic," *J. Eng. Education*, 41, 490-495 (1951).

# 3 DAYS THAT SAVED $10,000

## DOWELL solvent sprayer cleaned tank at fraction of ordinary time and cost

Rust has no place in motor oil. Yet rust deposits were contaminating the motor oil additive stored in this tank. The refinery operator decided that they had to be removed.

*His problem:* The refinery's storage facilities were limited. Thus outage time for cleaning the interior of the 60 by 45 foot tank was crucial. And he estimated sand blasting would take six weeks, cost $12,000.

*His solution:* He consulted his local Dowell chemical cleaning engineers. They cleaned the tank with a special Dowell-designed tank spraying tool. The tool was used to spray thickened solvent, which clung to interior walls and ceiling. Also, the tool was used to flush the tank, spray regular solvent and, finally, to apply an anti-rust solution. No personnel had to enter the tank during cleaning.

*His results:* The contaminating rust was removed. Cleaning time totalled three days, including tank preparation and buttoning up afterwards. The operator saved about $10,000 in cleaning cost alone, not counting the saving in outage time.

Dowell tank cleaning is fast, avoids scaffolding, uses solvents and techniques tailored to solve your particular problem. Mobile Dowell units bring all cleaning materials and equipment to you. Call Dowell's chemical cleaning experts. For fast service, their offices and stations are located in major industrial areas. Or for more information, write Dowell Incorporated, Tulsa 1, Oklahoma, Department **L-33**.

*chemical cleaning service for industry*

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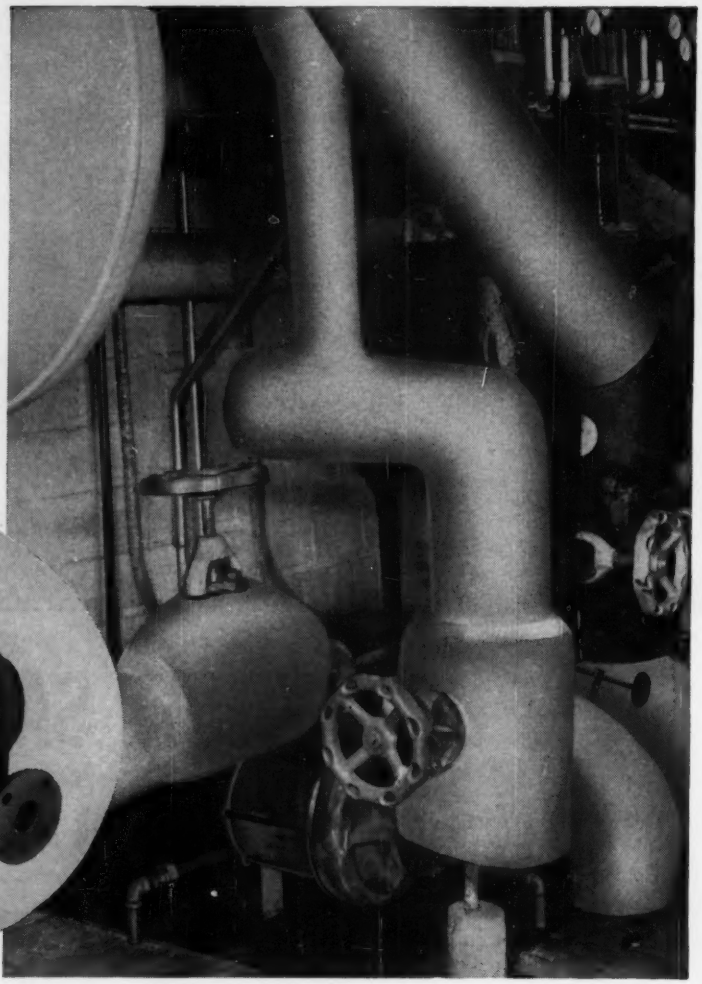
A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

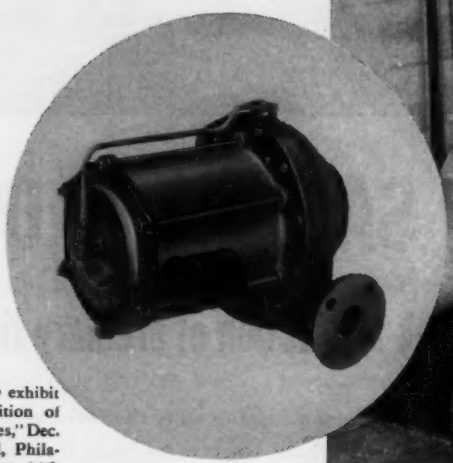
★ **no seals...no stuffing box**

# *Chempump*



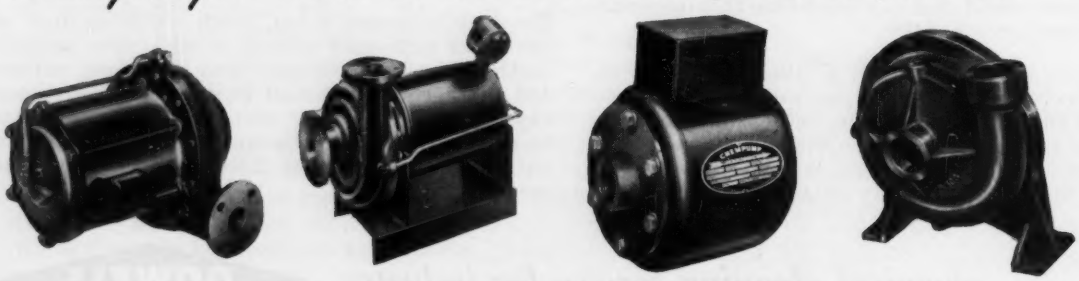
*Chempump* installed in American ENKA's Nylon Research Pilot Plant, Enka, North Carolina. 1 hp pump handles *Dowtherm* at temperature of 520°F.

***Pump capacity:*** **60 gpm.**
***Discharge head:*** **30 ft.**



**DON'T FORGET**
to visit the *Chempump* exhibit at the "25th Exposition of the Chemical Industries," Dec. 5-9, Convention Hall, Philadelphia, Booths 314 & 316.

## *Chempump*—first in the field . . . process proved



# for hard-to-handle HOT OILS

## *pumps heat transfer fluids, hot vegetable and mineral oils, silicone fluids . . . without leakage or contamination*

Hot oils are often hard to handle with conventional centrifugal pumps. Low surface tension and increased wetting action increase the problems of leakage, fluid loss, contamination, and maintenance. Besides being messy and expensive, leakage can present a real danger with some fluids.

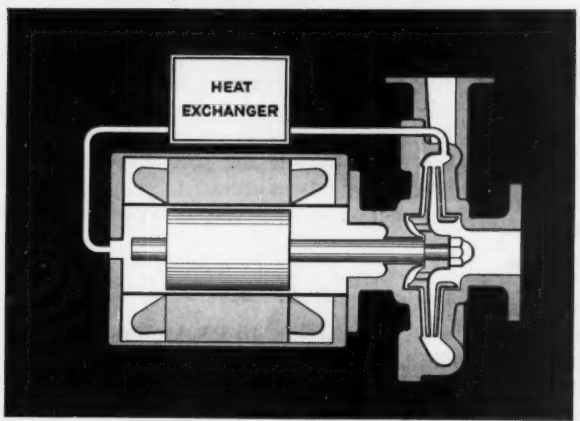
*Chempump,* by its very design, prevents these problems. With no shaft sealing device of any sort, *Chempump* can't possibly leak! Absence of a stuffing box means no packing lubricant—therefore no contamination even under extreme vacuum or pressure . . . especially important when handling hot vegetable oils.

*Chempump* can handle fluids at temperatures up to 450°F without need for special cooling devices. Use of a simple heat exchanger in the circulating line permits pumping of hot oils from 450°—700°F.

*Chempump's* seal-less design combines pump and motor in a single hermetic unit. Pump impeller and rotor are an integral unit. Statically and dynamically balanced, the rotor-impeller combination forms the only moving part. Pumped fluid enters the rotor chamber, isolated from the stator section by a corrosion-resistant, non-magnetic liner. No shaft sealing device is required.

*Chempump* seal-less pumps are proving their worth in thousands of money-saving installations throughout the world. Normally hard-to-handle fluids—hot, volatile, toxic, corrosive, explosive, sensitive, radioactive—just can't leak or become contaminated. For capacities, heads, and other application information, send for new 16-page *Bulletin 1010.*

*Engineering representatives in over 30 principal cities in the United States and Canada.*




Sectional view of Model CHS *Chempump.* Heat exchanger in circulating line used for applications in the 450°—700°F range.

*Chempump*

**CHEMPUMP CORP. • 1300 E. MERMAID LANE • PHILADELPHIA 18, PA.**

Please send me details on use of *Chempump* for:

_____
(application)

*Capacity*_____ *Total dynamic head*_____

*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

FINISH THIS SENTENCE IN 25 WORDS OR LESS:

*I am not further along in my career*

*because* _____

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**Completing the above won't bring you the $64,000 but if you neglect it you'll miss a fine chance to forge ahead in your career and lose an opportunity to . . .**

# Get an Edge on the Next Guy

AFTER you fill in the blank to your satisfaction, take it one step further. Marshal the evidence that proves that the reason you just gave doesn't really hold water.

You won't have much trouble finding instances of men and women who have gained success despite having been hampered by the same factor which you've just cited as the major obstacle to your own progress.

By yanking the rug from under that tendency which most of us have to kid ourselves along and make excuses for ourselves, this quick test can serve as a fine pushing off point for any self-improvement program.

### Pick of the Crop

You'll find this test in an early chapter of a just-published book* by veteran author, executive and editor Auren Uris. The new book ranks as one of the best of today's multitude of help-yourself-to-the-top tomes—mainly on the basis of its realistic, down-to-earth approach.

Uris eschews the traditional—and highly unsatisfactory—discussion of the "executive personality," in favor of practical, detailed instructions for sharpening specific skills. These skills form the edge which successful executives hold on those not quite as successful.

This approach gives the improvement-minded engineer or executive a chance to take what Uris calls, "a muscle-by-muscle course of self-training" in place of a disjointed striving for a winning combination of such much-mentioned, but elusive, qualities as being "achievement minded," "driving," "hardworking," "decisive," etc.

Though admitting that there are different types of executives, which can be identified and grouped by several general characteristics, the author believes that the successful executive relies mainly on a number of concrete skills rather than vague qualities. And just as one man can be taught the skills which make him a top-notch lathe-operator or pipe-fitter, so another can learn to groom the skills which make the efficient executive.

### Skills Are What Count

To illustrate: Take the "target-minded, driving" type of project engineer. This would appear to be the kind of executive who would be most successful at riding herd on a job and getting it completed within time and budget limits. While a "detail-minded" man might be a desirable choice for maintenance chief, where being able to retain details of equipment servicing, schedules, job assignments, etc., should be helpful.

But now switch the jobs or the approaches. Your "detail-minded" project engineer, by his pin-point knowledge of costs, equipment delivery dates, the performance of his men and so on, could make up for any weaknesses of his low-pressure approach.

While the "target-minded, diving" type of engineer could fill the maintenance chief post and make up for his weak grip on details by keeping a firm hand on getting and training a crew of first-class workmen, or pushing the bigger and tougher jobs through in a minimum of downtime.

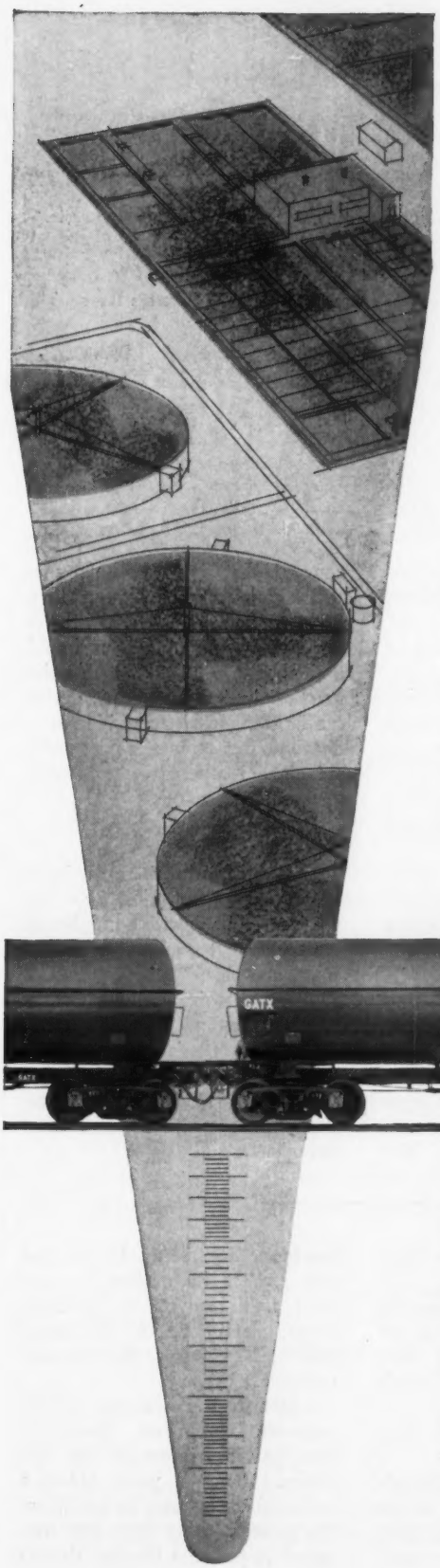
Mr. Uris' point is that if you have the basic executive skills it doesn't matter too much which type of approach you bring to your job, you'll have a good chance to be successful. And by concentrating on developing the skills you need, you can train yourself to gain the slight edge that cuts through to success.

### Honing the Slight Edge

In everyday life, Uris holds, individuals are pretty evenly matched. But while differences between the successful man and his less successful colleague are relatively small, the results of these differences can be mighty impressive.

Whenever you wonder, "What

* Uris, Auren, "Developing Your Executive Skills," McGraw-Hill Book Co., Inc., New York, 1955, $4.50.



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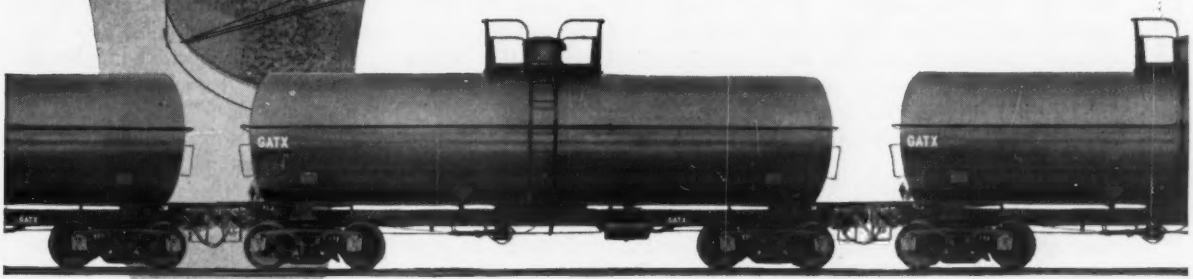
GATX pressure cars for chlorine do double duty. They not only serve as the shipping container, but as the storage tank as well. Accurate controls built into these cars permit users to unload the chlorine as it's needed. For greater flexibility, General American offers four sizes of cars—55-ton, 30-ton, 16-ton and multiple-unit cars carrying fifteen one-ton containers.

There's a GATX tank car that's built or can be built to meet your bulk liquid shipping needs. You can choose from over 200 types in the fleet of 48,000 cars designed, built and operated by General American. General American's 38 repair shops service these cars quickly and efficiently for you. For the *right* tank car for your product, write or call your nearby General American district office.




**typical products successfully shipped in GATX pressure tank cars** • *Anhydrous Ammonia* • *Butane* • *Propane* • *Ethylene Oxide* • *Propylene Oxide* • *Vinyl Chloride* • *Methyl Chloride* • *Ethyl Chloride* • *Chlorine* • *Carbon Dioxide*

**features of GATX pressure tank cars***

*All-Welded Tank, Jacket and Underframe* • *Flued-Dome Construction*** • *Safety Dome Platform (Available)* • *Painting to Specification (Available)* • *Insulation* • *Specially Designed Fittings (Available)*

**Standard equipment unless otherwise noted.*

***The one-piece flued-dome saddle was designed and pioneered by General American as early as 1938.*

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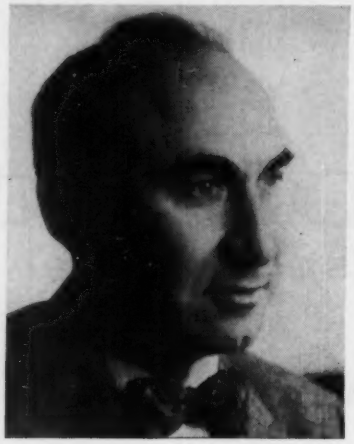


AUREN URIS, author of *"Developing Your Executive Skills"*

**Out of Context . . .**

**On Strong Points:**

"The big mistake many people make is to conclude that areas in which they are already proficient need little or no attention. The exact opposite may be true."

**On Delegating Authority:**

"If you're inclined to throw up your hands, *don't*. Reread this chapter and try again."

**On Doing Everything Yourself:**

"Nobody can do everything. That's why there are two sexes."

**On Interviews:**

"The interview may well be one of the most challenging situations you face. Frequently, it's a measure of you as much as it is of the interviewee."

**On Job Hunting:**

"Chances are that with *half* the effort he expends in outside job hunting, he could qualify for a better job in his own organization."

does he have that I don't have?" of another, you're admitting the validity of this principle. The differences may be small, but the results—well, they were what set you to wondering in the first place.

In the bulk of his book, the author explores in detail the skills involved in such functions as administration, decision making, planning, problem solving, communication, etc., and describes techniques for acquiring or improving them. These techniques embody latest findings of the Research Institute of America, one of the world's largest business research and advisory organizations.

**Using Modern Methods**

A fulltime writer and editor for the Institute and a leader of research projects in such fields as leadership, management and human relations, the author draws heavily on these modern methods to help the reader.

Onetime owner and operator of his own business, and with experience in both line and staff positions, Uris covers the entire range of skills needed by the executive. He divides the book's 32 chapters into seven sections, each covering a phase of the executive's job and the preparation for it.

Topics range from the most mundane—how to control your use of the telephone—to the intriguingly different—how to act when interviewed by the press.

Best sections are those that draw on recent research and common sense to debunk some of the current enthusiasms in executive development. For instance: In some quarters, listening is a current cure-all for human relations ills. Uris conceeds that giving another a sympathetic hearing can often help both you and the talker, and therefore it's a technique you should master. But he points out that the practical limitations of this device can be overlooked. After illuminating these limitations, he goes on to recommend alternate techniques for specific occasions.

**Studded With Helps**

To further help his reader learn or improve these skills, Uris has studded his book with a number of self-analysis tests and quizzes, charts and checklists and guides of all sorts. He's also been liberal with case histories and examples.

But the reader's biggest help is the author's extensive knowledge of his subject and his ability to express himself skillfully and interestingly.

---

# WRITING A RESUME

## . . . *How to Do It Well*

Hunting a new job is rarely what you'd call a pleasurable task. At times it can prove downright frustrating and discouraging—especially when you get a good one in your sights and then fail to bring it down.

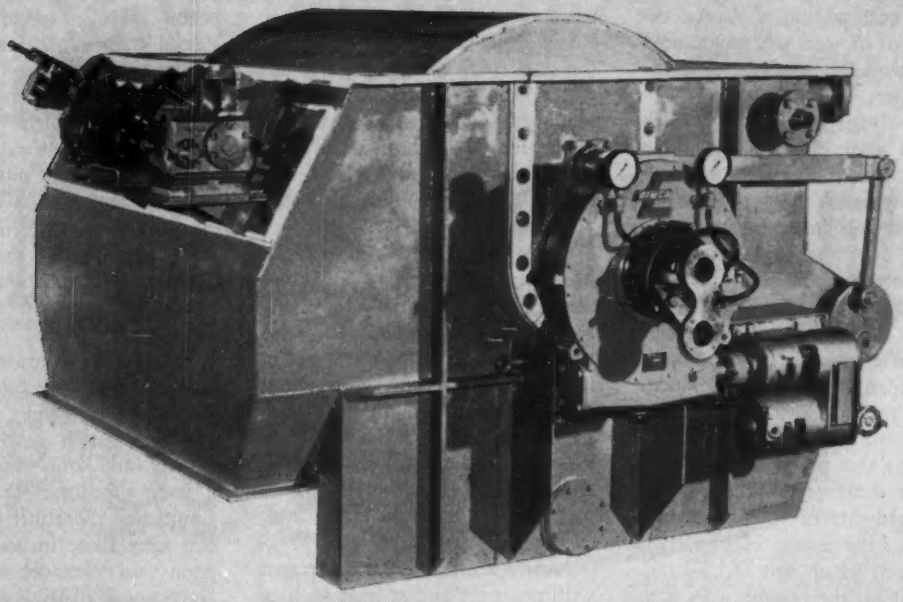
When this happens—or, better yet, before you start searching—check your ammunition. You may be firing blanks.

Most important shell in your arsenal is the resume. Chances are it's also the most neglected, since few chemical engineers get much practice in preparing them.

Here are the main points to keep in mind as you ready yours:

• List recent accomplishments first. Top half of the page is the critical area. In scanning your resume, the reader will crystallize his feelings before he has read very far. If he decides in your favor, he'll read on to the background material. Avoid the natural tendency to tell a chronological narrative.

• Stick to the facts and put the important ones first. *Important* here, means important to the reader. Giving a paper before a technical society may be just about the greatest thing that ever happened to you, but the fact that in



# Absolute Purity of Product Maintained with Eimco Filters

Absolute purity of product is maintained when using Eimco continuous vacuum or pressure filters. The picture above illustrates one of the many Eimco filters being used by industries that must maintain absolute purity such as antibiotics and other pharmaceuticals, food and allied industries and chemical industries.

To meet the requirements of these industries, Eimco makes all filters to specifications produced by cooperative efforts of the customer's engineering staff and Eimco's Research and Development engineers.

The filter shown above is a high submergence type filter designed for use with precoating material. The drum is all type 316 stainless steel and the tank is of mild steel with ¼" thick PVC lining. The lining is carried out through flanged connections and bolt-on-assemblies so that the white PVC material is visible from the outside. This filter is equipped with the Eimco Hyflow automatic valve for greatest efficiency in operation and the Eimco knife advance mechanism.

All of these features are significant to the type of application for this particular filter. Your problem receives the same detailed consideration by Eimco engineers who are specialized in filtration equipment. That is the reason Eimco filters work better, last longer, produce more and require less maintenance, square foot per square foot, than any other filter.

Write for more information on your specific problem.

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B-162

your current job you're responsible for the cost picture of several development projects will swing more weight with the reviewer. Add the other later.

• Give your salary level at each stage in your career. In the job market, this is an index of your value. Omit such things as what you should have been paid or what you thought you were worth—these mean nothing.

• State your age. If you leave it out, the reviewer will assume that you're too old. And the number of years before your retirement plays a major role in his deliberations.

It may also prove helpful to include a short section giving specific highlights of your experience —such as the results of important projects in which you had a hand.

Wind up the resume with such personal data as your date and place of birth, education, honors, publications, memberships, hobbies, etc. Don't neglect to include your current address and telephone number.

Crisp, concise wording will keep your resume brief and to the point. If it runs beyond two typewritten pages you may find that you are defeating your cause.

## GROWING MANAGERS

### . . . *A Developing Trend*

More and more companies are turning to organized programs for developing their future leaders. That's the conclusion drawn from a newly-published American Management Association survey of management development activity in 460 companies in all branches of American industry.

Fifty-four percent of the companies surveyed by AMA in 1954-55 boast a systematic plan program, or method to ease the development of people in or for management responsibilities. An additional 21% of the respondents shun formal programs, yet designate members of their organizations to guide or promote management development. In all, 88% of the responding firms give regular attention to the problem.

▶ **Still New**—More than 80% of the reported programs have operated for ten years or less and more than 60% are only five years old or less, underscoring the newness of this trend.

While all of the development plans covered in the study take an orderly approach to the supply, maintenance, and improvement of management personnel, they vary a good deal in the specific techniques used. Commonest are conferences and group discussions, coaching by the individual's immediate superior and periodic reviews and audits of performance. About a third of the companies use one or more of these three methods.

Nearly a fifth of the companies with programs and at least 16% of those without systematic activity make important use of psychological testing. Some also use psychological counseling of supervisory and managerial employees.

▶ **Range of Methods**—Other techniques reported include in-company training courses; job experience on a planned basis; systematic attendance at conferences and technical meetings at company expense; understudy or "assistant to" positions; planned job rotation and/or transfers; individual memberships in professional or technical societies at company expense; management courses in colleges or universities; other outside-company courses; special trainee positions; showings of films and slides; committee, special project, survey, or other assignments; case-problem studies; assigned or optional outside reading and study; "junior board" or multiple-management plans; small-group discussions; training by outside consultants or specialists; planned visits to other companies; workshops; panels; role-playing sessions; and forums.

Among the companies running definite programs for developing management people, more than half like the results they are getting and only 2% expressed definite dissatisfaction. Generally, companies reporting greatest success were those in which the program has clear-cut and specific aims, covers all levels of managerial personnel, employs a variety of methods and has been in effect for ten years or more.

NEXT MONTH:
**YOUR JOB OUTLOOK**

**If you find yourself job-hunting in the next 12 months, will you be in for a fairly easy time of it or will your really have to scrounge around? What will the salary outlook be? You'll get a preview glimpse of the situation for each age group and work category, a peek at the salary outlook and a chance to scrutinize some of the other factors that will make '56 a good or a bad year to switch jobs. All in January's YOU & YOUR JOB.**

## FELLOWSHIPS

### . . . *Now Available*

Chemical engineers who want to work toward an advanced degree and who are hunting fellowship assistance should check with the National Science Foundation.

NSF intends to make some 750 awards for graduate study in the academic year 1956-57. Stipends will vary from $1,400 for those with less than a year of postgraduate work to $3,400 for postdoctoral study. Winners also qualify for tuition, lab fees and limited travel allowances. In addition, married men can get dependency allowances.

The fellowship enables you to study at any school of your choice, here or abroad.

You can get applications from the Fellowship Office, National Research Council, Washington 25, D. C. For postdoctoral awards Dec. 19, 1955, is the closing date; applications for advanced degrees are due Jan. 3, 1956. Winners will be announced March 15, 1956.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

# POWELL LUBRICATED PLUG VALVES

FIG. 3059G—300-Pound Steel Flanged End Valve. Sizes 6" to 12".

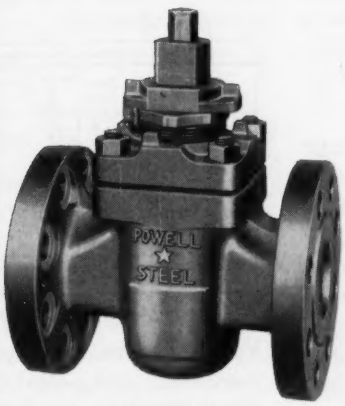


FIG. 1559—150-Pound Steel Flanged End Valve. Sizes 1" to 4".

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

Powell Valves—the *complete* quality line—offer many outstanding features in these new Lubricated Plug Valves, such as quick and sure operation and a positive seal when the valve is closed.

Valves are available with screwed or flanged ends; single, screwed and bolted gland types, and in Semi-Steel, Carbon Steel, Bronze, Ni-Resist, Monel Metal, and Stainless Steel. Semi-Steel valves are rated 175 and 200 pounds W.O.G.; Steel valves, 150 and 300 pounds W.P. Sizes from 1" to 12". Valves in sizes 6" and larger can be furnished with gears for gear operation. Distributors located in principal cities. For descriptive literature—or help on valve problems—write direct to

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# These 12 users needed the **corrosion resistance** of PYREX pipe

## *Were they worried about breakage?*

Probably.

And if you share the same need and have the same doubts, we can imagine your position.

On one hand, you're plagued by the high-cost and headaches of pipeline corrosion — constant replacement, clogged lines, interrupted production.

On the other hand, nagging doubts keep you from making the one decisive test that could, in time, lead to your saving your company untold amounts of money. The test? An actual installation of PYREX brand glass pipe.

You're afraid it will break.

If you've never had any experience with PYREX pipe, that's understandable. Almost every purchaser of this pipe has had to overcome this fear by logically measuring the value of its corrosion resistance against the possibility of breakage.

### How these companies found out

It would be safe to say every one of the 12 companies represented in the pictures went through a worry period before approving the first glass pipe installation.

And most of these installations began in the same way:—buyers installed a *test length* of PYREX pipe. Sometimes it was a length of glass between metal lines; sometimes a length where corrosion's effects would be most brutal and breakage most likely.

### Experience banishes fear of breakage

Obviously these companies were satisfied with results, else they wouldn't have PYREX pipe in their plants today—miles of it in some cases, and some of it in use for 20 years.

Tests showed them, as a test would show you, that experience with PYREX pipe banishes fear of breakage—that it is safe for you, too, to take advantage of the tremendous corrosion resistance of glass in your processing lines.

Suppose you tried a test—what might you learn . . .

### About corrosion?

You'll find that PYREX pipe does a superlative job with such acids as sulphuric, hydrochloric, nitric, acetic; and with such other chemicals as chlorinated hydrocarbons, hydrogen peroxide, bromine, brines, and low-concentration alkaline solutions.

This chart shows you chemical corrosion rates with representative corrosive chemicals.

CHEMICAL CORROSION RATES—Glass No. 7740

| Reagent | Temp. ° F. | Time, Hours | Weight Loss, Mg per Sq Cm | Inches, Thickness Lost per Year |
|---|---|---|---|---|
| 5% NaOH | 212 | 6 | 1.4 | .36 |
| N/50 $Na_2CO_3$ | 212 | 6 | .12 | .031 |
| 5% HCl | 212 | 24 | .0045 | .0003 |
| 3% $NH_4OH$* | 176 | 100 | .33 | .0051 |
| 85% $H_3PO_4$ | 212 | 24 | .009 to 0.19 | .0006 to .0010 |
| $H_2O$ | 212 | 6 | .0005 | .00013 to .00021 |
| | | 48 | .0066 | |
| 5% Sea salt | 212 | 24 | .03 to .08 | .002 to .005 |
| 20% Sea salt | 104 | 100 | .025 | .0004 |

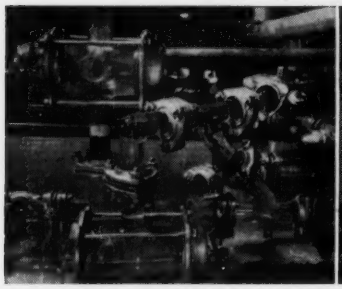
*Maximum corrosion rate for this temperature occurs for concentrations between 0.5 and 3.0%.

### About cleaning?

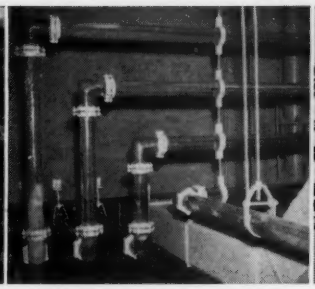
You'll welcome the freedom from slowed-up, sludge-filled lines that PYREX pipe gives you. Hard, smooth glass offers no purchase for costly buildup. And you can clean glass pipe with an acid or detergent agent, live steam or clear water. You *see* when pipes are clean—and when they need cleaning.

### About installation?

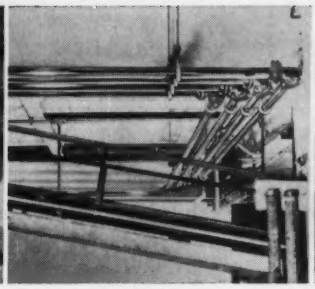
Over 75% of the PYREX pipe now in use has been installed by our customers' own pipe fitters. It's easy to plumb, even with difficult layouts. Hangs easy, too. We have an installation manual to guide your people.



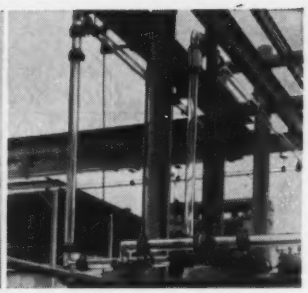
Alkaline Organic Solvents and Muriatic Acid



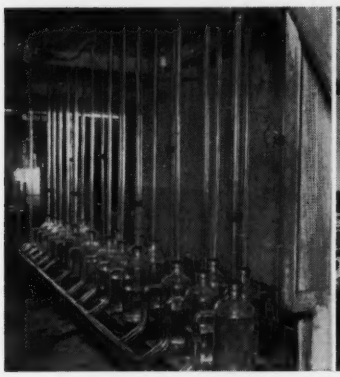
Generating Chlorine Dioxide



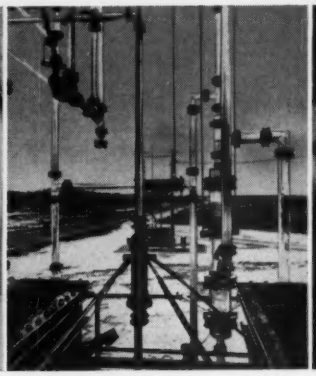
Bottling Plant Lines



Mono-chloro Benzene

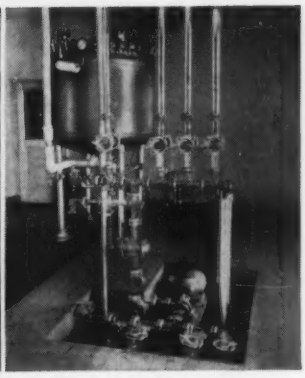


Corrosive Solvents



Hydrochloric Acid

Dilute Nitric - 200° F.



Sensitive Pharmaceuticals

And once PYREX pipe is up, it's up for as long as you need it.

**About maintenance?**

You'll find maintenance limited to occasional inspection of joints and, once in a while, tightening flange bolts.

**About cost?**

You'll find the installed cost of PYREX pipe as low as *any* corrosion-resistant material and lower than most. Service life is long. You will probably never need to replace the line you first install. Economy is one of glass pipe's most attractive features.

**How YOU can find out more**

*You can depend* on us and upon our distributor in your area (see list) for factual answers to any question you might have about PYREX pipe. Write, wire, or phone us or our nearest distributor or send the coupon below for more detailed information about PYREX brand "Double-Tough" glass pipe.

*If you are not now enjoying the trouble-free corrosion-resistance of* PYREX *brand glass pipelines because you are worried about breakage, why not talk to some of the people who are using it daily? We'll be glad to furnish the names of companies near you.*

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- ☐ EA-1: "PYREX Pipe in the Process Industries" (Illustrated case histories)
- ☐ EA-3: "PYREX brand 'Double-Tough' Glass Pipe and Fittings Catalog"
- ☐ PE-3: "Installation Manual for PYREX Pipe"
- ☐ Please have your representative call on me.

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**Big Improvement in Mechanical Properties**

| | Austenitic Iron (Flake Graphite) | Ductile Austenitic Iron (Spheroidal Graphite) |
|---|---|---|
| Tensile strength, psi | 25–35,000 | 55–69,000 |
| Yield strength, 0.2% offset, psi | ..... | 32–36,000 |
| Elongation, % in 2 in. | 1–3 | 8–20 |
| Proportional limit, psi | ..... | 11–18,500 |
| Modulus of elasticity, psi $\times 10^{-6}$ | 15–16.2 | 16.5–18.5 |
| Hardness, Brinell | 130–160 | 140–180 |
| Impact toughness, V-notch, ft. lb | ..... | 12 |
| Shrinkage, in. per ft | 0.23 | 0.215 |
| **Elevated temperature properties:** | | |
| Tensile strength, psi. | | |
| 1,000 F | 17,000 | 47,750 |
| 1,200 F | ..... | 35,600 |
| 1,400 F | 7,500 | 22,150 |
| Stress rupture, 1,000 hr., psi. | | |
| 1,000 F | 10,000 | 30,000 |
| 1,200 F | 4,000 | 12,000 |
| Resistance to oxidation at 1,300 F. | | |
| Rate of oxide penetration, in. per yr. | 0.067 | 0.042 |

Compositions involved in this comparison contain 2% Cr, 20% Ni, and 1% Mn (approx. percentages). Values for flake graphite austenitic iron apply to Type 2 Ni-Resist. Values for elevated temperature properties of the ductile austenitic iron are for the composition containing 2.36% Cr, 20.48% Ni, and 1.15% Mn.

# Now: Ductile Austenitic Iron

**Strength and ductility approaching that of cast steel are incorporated into the new cast iron. Corrosion and erosion resistance of austenitic irons are retained.**

Ductile austenitic cast iron is the latest development of The International Nickel Co. in the field of cast metals. Using the process originated with ductile cast iron—treatment with magnesium—it combines higher mechanical properties with the resistance of the austenitic irons to corrosion, erosion, and metal-to-metal wear. Resistance to elevated temperatures plus the castability and machinability of the conventional austenitic irons are also retained in full.

Because of the austenitic matrix, the yield and tensile strengths as well as the proportional limit and modulus of elasticity are relatively low compared with the ferritic, pearlitic, acicular and martensitic ductile irons. The elongation and impact toughness of the austenitic types in the as-cast condition average higher than in the other types of ductile irons, however.

Values in the table are for the as-cast condition. By using metal molds to get finely divided carbides (a result of rapid freezing-in), and by heat treating at 1,700-1,900 F., strength is materially increased. Tensile values go to 75,900-83,500 psi., yield strengths to 42,500-46,200 psi., elongation to 13.5-30 and Brinell hardness to 165-190.

*Information about ductile austenitic cast iron presented here is from the paper by F. G. Sefing, Development and Research Div., International Nickel Co. 67 Wall St., New York, N. Y., given before the 1955 meeting of the American Foundrymen's Society.*—Ed.

### Applications

Ductile austenitic iron is being applied successfully in pump cases and impellers, engine liners, supercharger parts and furnace castings. Because of its good castability, it is already replacing some of the corrosion-resistant alloys more difficult to handle in foundry operations.

For special purposes such as high expansivity and non-magnetic response, variations in composition may be used.

(*Corrosion Forum, cont.*)

# We've used "KARBATE" equipment for years and we're still finding places where it pays off!

■ Many users of "Karbate" brand impervious graphite process equipment originally installed it where nothing else would work — then went on to extend its use to other, less severe, process-unit locations. A job doesn't have to be a major headache for "Karbate" equipment to pay off. *Wherever* corrosive conditions exist, consider "Karbate" impervious graphite and "National" carbon and graphite. You'll be pleased with the economies they offer.

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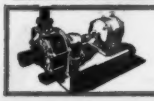
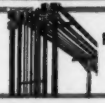
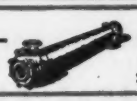
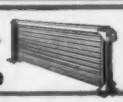

Pumps—Catalog Section S-7250


Pipe and Fittings—Catalog Section S-7000


Heat Exchangers—Catalog Sections S-6740 and S-6840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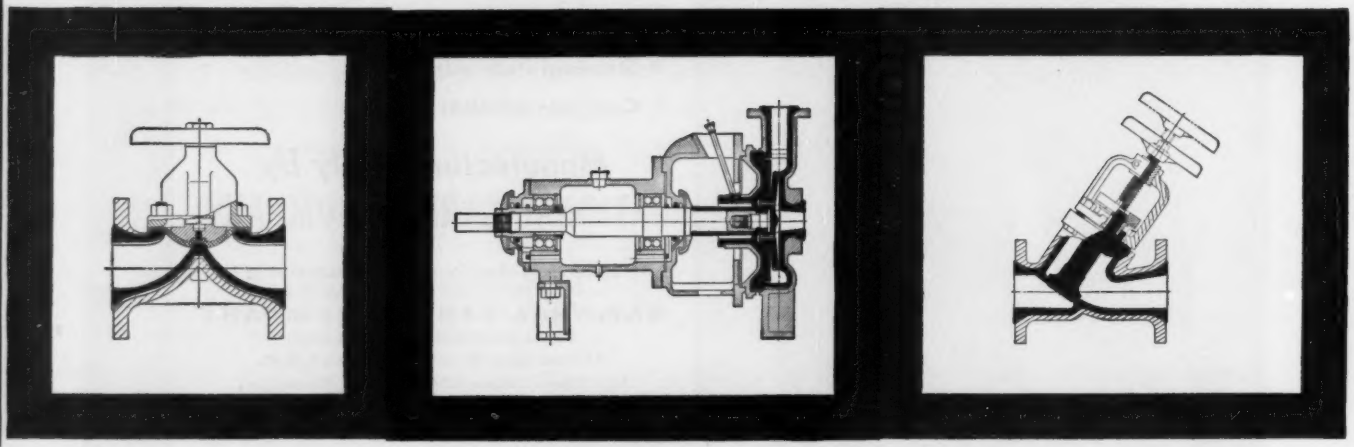

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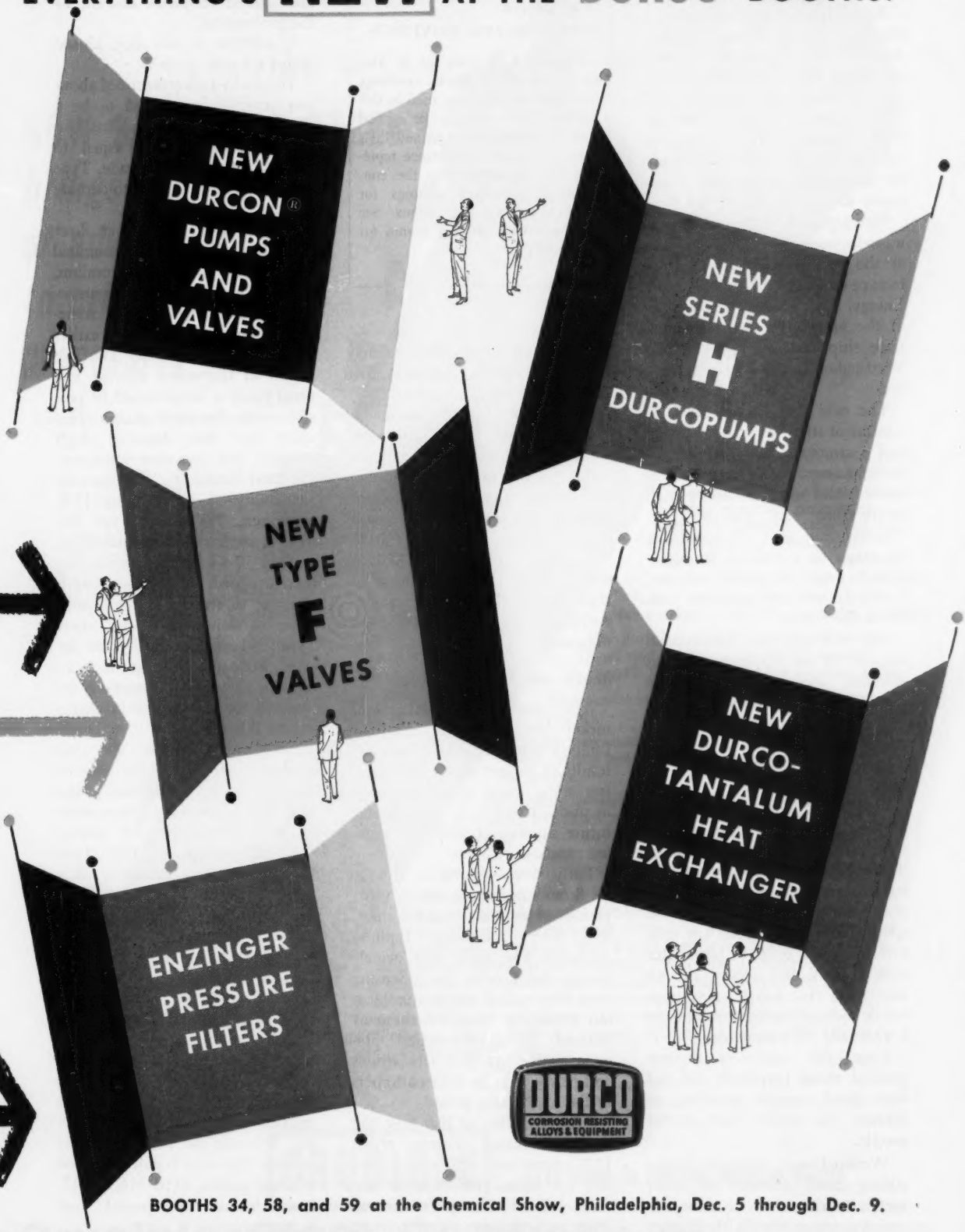



**BOOTHS 34, 58, and 59 at the Chemical Show, Philadelphia, Dec. 5 through Dec. 9.**

**THE DURIRON COMPANY, INC., DAYTON, OHIO**

## New Zirconium Alloy

Researchers at the Westinghouse Electric Corp. atomic power division have developed a new zirconium alloy. The new alloy is so resistant to the extremely corrosive action of high temperature, high pressure water in nuclear reactors that in a year's time only ten-thousandths of an inch of corrosion can be measured.

Development of the new alloy was disclosed by D. E. Thomas at the recent International Conference on Peaceful Uses of Atomic Energy. Dr. Thomas is manager of the metallurgy section for the large ship reactor project at the Westinghouse atomic power division.

The new alloy is the result of months of study aimed at trying to find a structural metal capable of withstanding the intense corrosive attack of water under high temperature and pressure. Dr. Thomas said that the corrosion resistance of zirconium in superheated water is greatly affected by the amount of impurities present in the metal.

For example, an infinitesimal amount of an impurity such as nitrogen mixed with a large quantity of zirconium would make the difference between complete disintegration within a day, and a life of years in high temperature water.

Two operations were necessary to make pure zirconium prior to the development of the new alloy. The Kroll process, whereby zirconium chloride is reacted with magnesium to form a mass of sponge zirconium metal, was used first. Then, in order to purify this even further, the deBoer process was used in which zirconium iodide was converted to metal on a white-hot zirconium wire.

Even this expensive doubly-purified metal frequently did not have good enough corrosion resistance to satisfy the reactor people.

Westinghouse scientists began adding small amounts of other metals to zirconium to make corrosion-resistant alloys. Many were useless because of their natural capacity for holding neutrons thus preventing a nuclear reaction.

Of all the elements examined, tin was found to be the most satisfactory in that it did not absorb many neutrons and it counteracted the harmful effect of some of the impurities. The new alloy contains 1.5% tin, 0.12% iron, 0.10% chromium and 0.05% nickel. With the combination of these metals, the desired corrosion resistance properties have been obtained.

NEXT MONTH:

**IMPROVED ZINC COATINGS**

**Developed 15 years ago in Australia, zinc-filled silicate coatings have only recently been used in this country. Their ability to be applied cold to existing structures and their increased corrosion resistance represent big advantages over the conventional galvanized coatings for chemical industry applications. See next month's Corrosion Forum for the highlights.**

## More on Mn Stainlesses

The continuing shortage of nickel has prompted Allegheny Ludlum Steel Corp. to release the results of further research in stainless steels made with manganese in place of nickel, to assure ample future supplies of austenitic stainless steels.

Early work was done in the U. S. and in Europe during other periods of temporary nickel shortage, and Allegheny Ludlum marketed one such alloy widely during the Korean War. Sensing that the nickel supply problem was certain to recur, the company pursued its developmental program within its own laboratories and in cooperation with customers in the intervening period.

The first alloy of this type the company offered contains about 15% chromium, 15% manganese, and 1% nickel. This was the material offered during the Korean War, and the low nickel content was dictated by the restriction then placed on nickel content by the government.

In addition to this alloy, several others are now available.

The 15-15-1 alloy described above was generally considered to be a sheet and strip alloy, and has corrosion resistance about equal to the straight chromium grade, Type 430, and slightly inferior to chrome nickel grades of stainless.

Now available is another sheet and strip alloy with a nominal composition of 17% chromium, 4% nickel, and 6% manganese. This material, while using somewhat more nickel than the earlier grade, will stretch the available supply of the scarce alloying material twice as far as would be possible with the usual grades. This alloy has the desirable high strength and corrosion resistance, the good formability, and the easy weldability of the popular 17% chromium, 7% nickel Type 301 that is so familiar to fabricators.

The 17-4-6 alloy, which has been assigned AISI Type 201, is resistant to atmospheric and most other corrosive conditions where Type 301 may normally be applied. Few, if any changes in tools, dies, or of forming operations are required for a fabricator in changing to this material.

Allegheny Ludlum also has available another stainless alloy in the same nickel-saving family, this time with a nominal composition of 18% chromium, 5% nickel, and 8% manganese—AISI Type 202. This is an austenitic alloy developed as an alternate for Type 302, and mechanical properties and corrosion resistance are similar to that material. This alloy will probably be available in the future in other products, as well as the sheet and strip now marketed.

The chrome-manganese family is not yet complete. There are not yet alloys available to take the place of the high temperature stainless types, such as Type 309 and 310—nor are there alternates now for the extra highly corrosion resistant grades, Type 316 or 317. Research and development work is continuing.

# HOW STAINLESS STEEL *brings a whole set of advantages to critical processing jobs*

This 60-inch diameter nitric acid absorber tower typifies the application of stainless steel in the chemical processing industry. Made by the Vulcan Manufacturing Division of Cincinnati, Ohio, it is an excellent example of how several properties of a *specific type* of stainless team up to solve a tough chemical processing problem.

The stainless that Vulcan chose for the all-welded body is Crucible Rezistal® Type 347. Here are three big reasons why:

**High tensile strength** to minimize structural support.

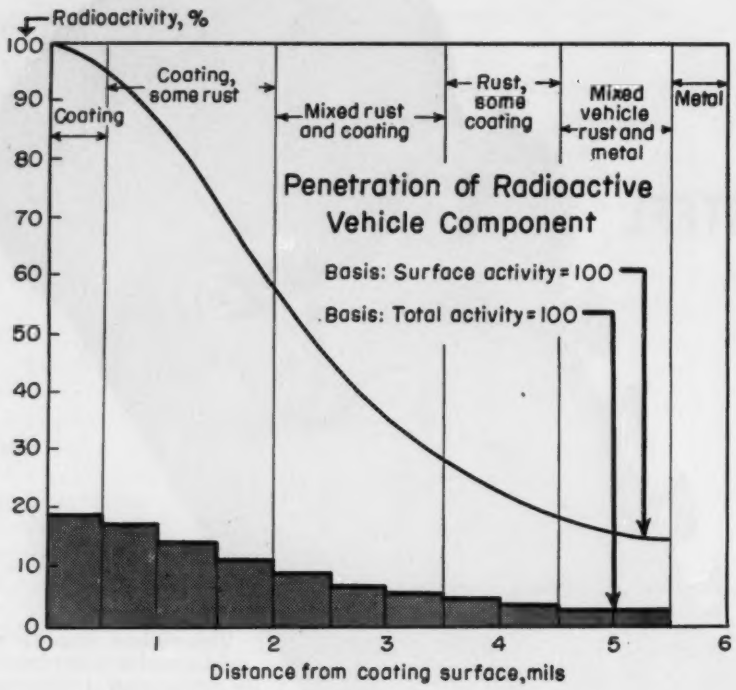
**Stability** against formation of harmful carbides, both during welding and in high-temperature operation.

**Remarkable corrosion-resistance** to withstand lasting exposure to nitric acid. It is fully resistant to the acid in diluted form at any temperature, and to concentrated solutions at lower temperatures. It is satisfactorily resistant to concentrated solutions above the boiling point.

Your operations may not call for nitric acid absorber towers, but if they include any critical phase of chemical precessing, check the many advantages offered by the 30 available types of Crucible stainless steel. You'll find details in "Making the Most of Stainless Steels in the Chemical Processing Industry," which is yours free on request. And, to find out what information is available on the many other Crucible special steels, ask for "Crucible Publication Catalog." Or consult your nearby Crucible representative. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

**CRUCIBLE** first name in special purpose steels

**Crucible Steel Company of America**




# New Coating Evaluator

**Depth of penetration of oil-based coatings through rust layers can now be measured by the use of radioactive tracers.**

This new detection method was developed by technologists of the Battelle Memorial Institute, Columbus, Ohio—using a fish-oil based product of the Rust-Oleum Corp., Evanston, Ill.

First, it was necessary to identify one or more of the major chemical constituents in the fish-oil-based vehicle of the coating.

Second, this constituent was synthesized, using radioactive $C^{14}$.

Third, the $C^{14}$ labeled constituent was added to the fish-oil-based vehicle making it radioactive. The radioactive vehicle was then processed by the manufacturer into a radioactive coating equivalent to the manufacturer's standard product.

Fourth, the radioactive coating was applied to rusted steel test panels and allowed to dry for two weeks.

Fifth, the coated test panels were shaved downwards from the surface at 0.5 mil intervals and radioactivity measurements taken at each level down to bare metal.

Lengthy research was devoted to determining which components would be most suitable for radioactive tracer synthesis studies. It was found that a major component, common to all fish oils, is glycerol in the form of triglycerides. The glycerol portion of the fish oil was then replaced by $C^{14}$ labeled glycerol. This was done by obtaining the fish oil fatty acids by saponification of fish oil, and by re-esterifying these fatty acids with $C^{14}$ labeled glycerol—thereby obtaining a radioactive re-constituted oil.

In addition to months of laboratory testing, the manufacturer conducted exhaustive tests in weatherometers and in the extremes of atmosphere exposure areas throughout the country to be sure that the synthetic procedures used in the research to radioactivate the fish oil did not change standard product performance.

After more than one year of testing the radioactivated coating, the procedures to measure the penetration through rust were started. To determine the degree of penetration of the coating into rust, seven badly rusted steel test panels were used with complete logs maintained on each specimen. These test panels were scraped and wire-brushed. The radioactive primer was then brushed on directly over the sound rusted surfaces and allowed to dry for two weeks. Following this, the coated test panels were placed in a lapping fixture that made possible controlled removal of the surface layer using crocus cloth as an abrasive. The surface was then lapped at an approximate 0.5 mil levels down to the bare metal surface and the radioactivity in the coating measured at each level by Geiger-Mueller tube and Gas Flow Proportional Counter.

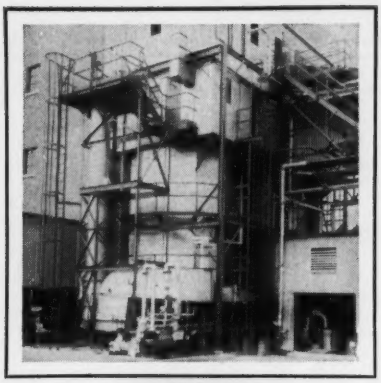
Plotting radioactivity vs. distance from coating surface, as above, gave the information desired.

## High Temperature Data

Information on the high temperature corrosion behavior of 31 materials ranging from cast iron to lead and including some nonmetallics has been tabulated and published by the National Association of Corrosion Engineers, 1061 M & M Bldg., Houston. The report "High Temperature Corrosion Data" was compiled by Technical Unit Committee T-5B on High Temperature Corrosion.

Data covers a number of stainless steels and high alloys subjected to temperatures over 400 F. Corrosion rates are indicated as low, moderate or high versus specific temperatures.

Copies are available at 50c.



# THE WYSSMONT Turbo Dryer®

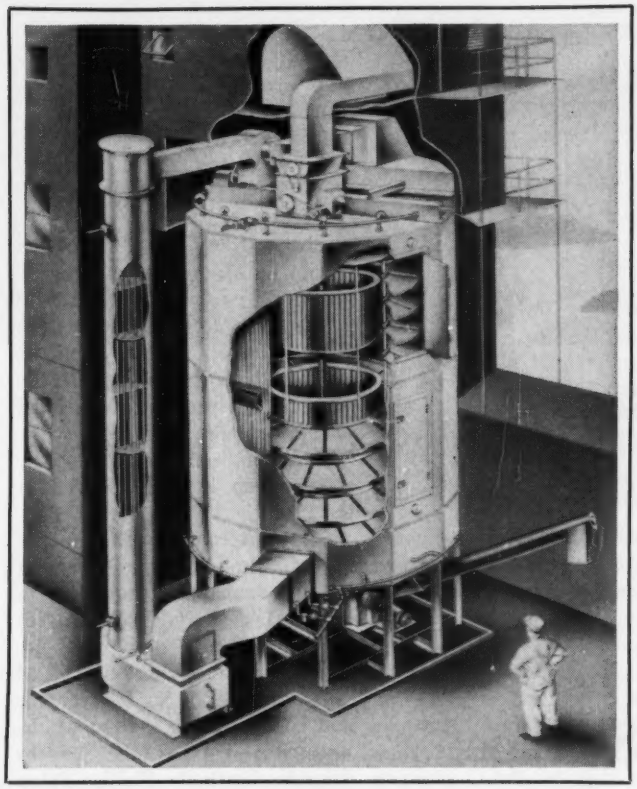
## CLOSED CIRCUIT SYSTEM

***with recirculation of inert gases, conditioned air and vapors***

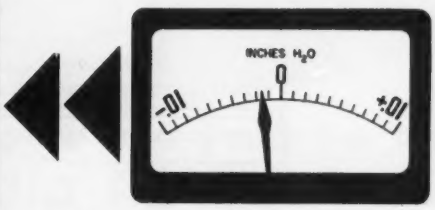
*offers unusual advantages for*

## CONTINUOUS

- Low temperature drying
- Drying with solvent recovery
- Drying in inert or protective atmosphere
- Sublimation
- Gas-Solid Reactions
- Drying with superheated vapors



The Turbo Dryer consists of a tray rotor, centrally located turbo fans and insulated housing. The product on each tray is wiped off after the tray completes one revolution, falling on the tray below in a pile, which is leveled. From the lowest tray, the product drops onto the dryer bottom, whence it is swept into the discharge spout.




*Negligible pressure drop through Dryer permits operation at slight negative pressure, hence very small gas makeup required.*

## ADVANTAGES

- SAFETY OF OPERATION, NO EXPLOSION HAZARDS
- DUSTLESS OPERATION
- HIGH THERMAL EFFICIENCY
- HIGH SOLVENT RECOVERY
- SMALL INERT GAS MAKE-UP
- OUTDOOR INSTALLATION
- LOW MAINTENANCE

***Successful installations attest to the merits of this system***

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**DRYING • SUBLIMATION • OXIDATION • COOLING**

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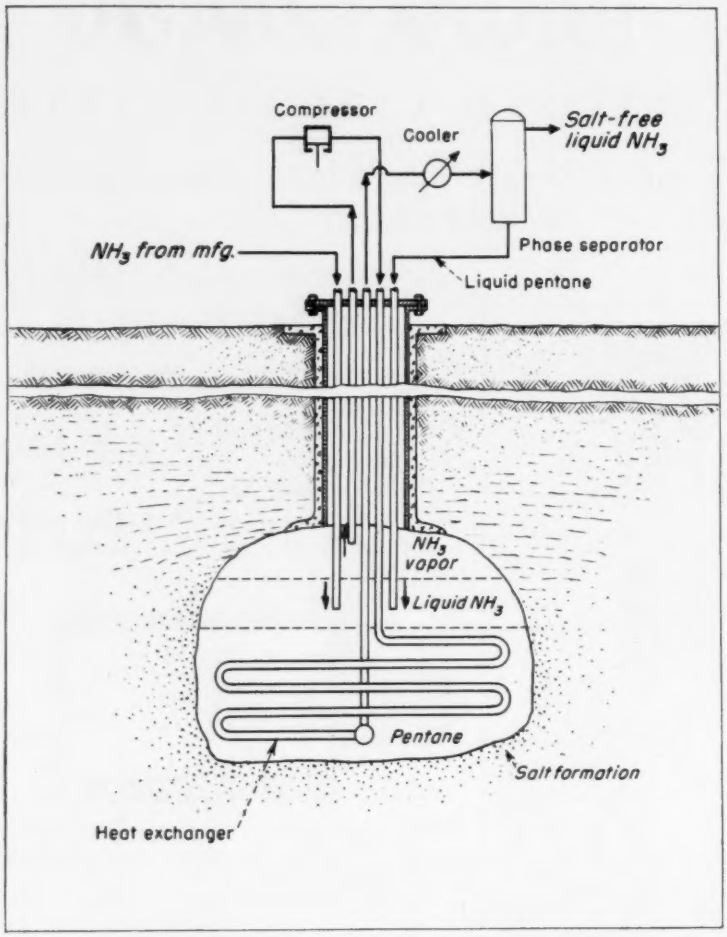
***Representatives in principal cities***




# Salt-Free $NH_3$ from Storage

**Evaporation followed by cooling is the latest method for recovering salt-free, liquid ammonia from underground storage caverns.**

The problem of ammonia storage, particularly in seasonal industries such as the fertilizer industry, has been largely solved by the use of underground storage caverns. But the standard technique of drilling into salt beds and dissolving out part of the salt to provide a fluid-tight storage area has one major disadvantage: Most salts (e.g., NaCl) are ammonia-soluble and must be removed.

Phillips Petroleum Co. gets around this difficulty with a new method for recovering salt-free ammonia.

▶ **Vapor Compression**—Liquid ammonia is pumped to an underground storage cavern formed in a subterranean salt formation. A heat exchanger is submerged in the ammonia and covered by an inert liquid such as pentane. Ammonia vapors are taken from the top of the storage cavern to a compressor.

▶ **Evaporation and Crystallization**—Hot ammonia vapors leaving the compressor are pumped back to the heat exchanger and liquefied. And the heat given up by the vapors is transferred to the pentane which, in turn, heats and partially evaporates some of the liquid ammonia stored in the cavern.

As ammonia evaporates, dissolved salts crystallize out of solution. But, instead of depositing on the heat exchanger, they settle in the pentane at the bottom of the cavern.

Liquid ammonia passes from the exchanger to a cooler, thence to a phase separator. Here any pentane which has vaporized along with the ammonia is separated and returned to the cavern.

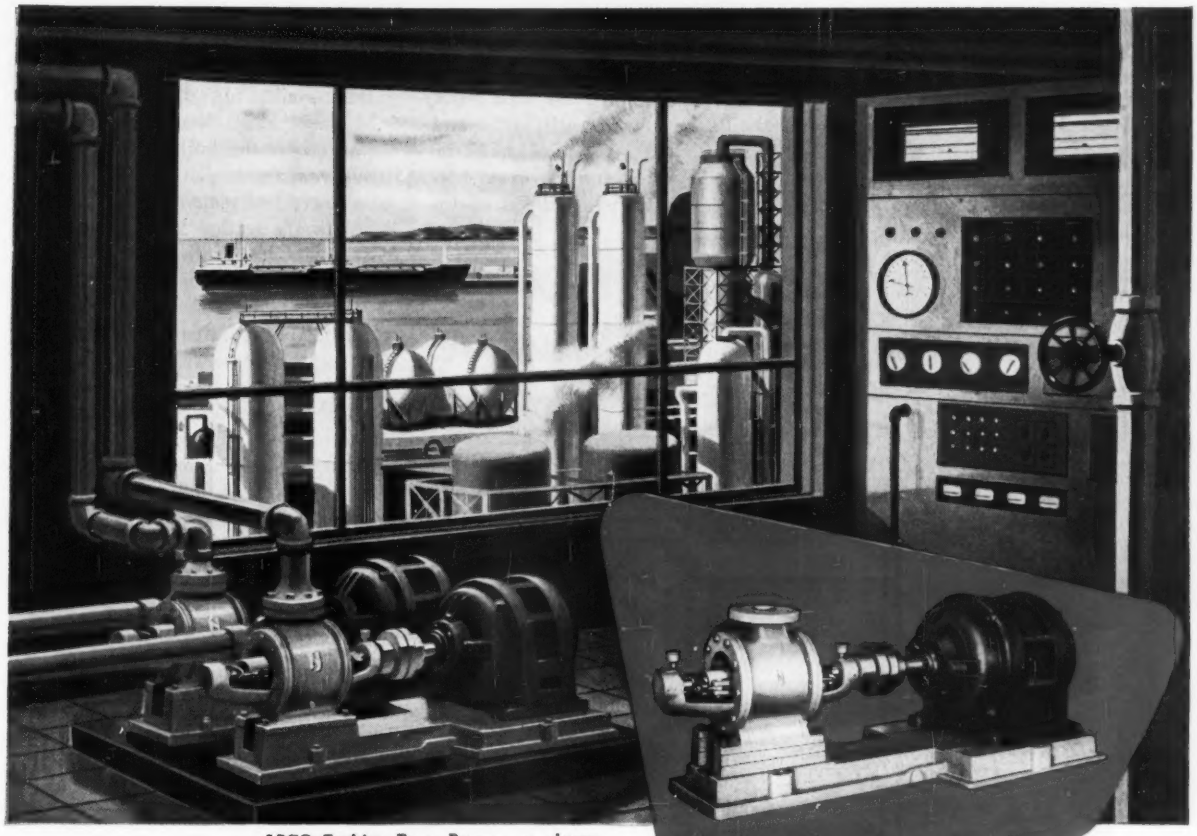
▶ **Modification**—A variation of the above set-up is also described in the patent.

Briefly, it consists of (1) pumping liquid ammonia from the cavern to an evaporator containing a heater covered with pentane, (2) heating and evaporating the ammonia, (3) removing crystallized salts which settle in the pentane and collect at the bottom of the evaporator.—**U. S. 2,713,775 by John E. Cottle to Phillips Petroleum Co.**

## Fluorides Extract Aromatics from Naphthas

A liquid mixture containing silver fluoride and anhydrous hydrogen fluoride is the key to this process for extracting aromatics from petroleum naphthas.

Silver fluoride reacts with the aromatics to form a complex which is very soluble in liquid HF. And AgF, unlike $BF_3$, has no catalytic effect—that is, as far as either disproportionation reactions or



*APCO Turbine Type Pumps, as shown here, serve in the Petroleum Industry*

# Petro-Chemical Production, Profits and Progress and—

# FLUID POWER

Many industries lean heavily upon pumps for various stages of production. But in none is there a more definite tie-up between the profit and loss statement and Fluid Power than in Petro-Chem and Petroleum Refining. The movement of liquids (to perform the essential operations for converting them from raw material to finished product), entails a wide variety of conditions and requirements. There are, for example: high pressure/small volume . . . low pressure/large volume . . . accurate, metered flow . . . icy cold, boiling hot . . . acid, alkaline or neutral . . . clear clean, colloidal or semi-solid. And, for any of these conditions there's a pump bearing The New York Air Brake Company mark ideally suited to do the job. For liquid handling services: AURORA Turbine and Centrifugal Pumps and KINNEY Heliquad Gear and Rotating Plunger Pumps.

DUDCO, HYDRECO and STRATOPOWER high pressure Hydraulic Pumps provide Fluid Power for rotary or linear motion in process automation or for added safety where toxic, flammable or explosive materials are present. There are: HYDRECO Gear Type Pumps and Motors, Valves and Cylinders for 1000/1500 psi operation . . . DUDCO Dual-Vane Pumps and Motors for 2000 psi circuits and . . . DUDCO and STRATOPOWER Piston Pumps delivering pressures to 5000 psi.

Finally there is Fluid Power in reverse . . . KINNEY High Vacuum Pumps to step up distillation, dehydration, deaeration and other production and profit functions.

**DUDCO DIVISION**
**Hazel Park, Mich.**
**Dual-Vane Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 7 to 140 hp; 2000 psi operation. Piston-Type Pumps for 5000 psi.**

**HYDRECO DIVISION**
**Cleveland, Ohio**
**Gear-Type Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 3 to 52 hp; Cylinders; Control and Auxiliary Valves; 1500 psi.**

**WATERTOWN DIVISION**
**Watertown, N. Y.**
**Railroad air brake valves for freight and passenger equipment, STRATOPOWER Hydraulic Pumps for Aircraft, to 3000 psi.**

**KINNEY MANUFACTURING DIVISION**
**Boston, Mass.**
**Rotating Plunger and Heliquad Liquid Handling Pumps, to 3000 gpm. Vacuum Pumps, 0.2 micron, evacuate 1800 cfm.**

**AURORA PUMP DIVISION**
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**Liquid Handling Pumps, Centrifugals and deep well Turbines, 7000 gpm, 500 ft. heads. Turbine-type, 150 gpm, 600 ft. heads. Condensate Return Units.**

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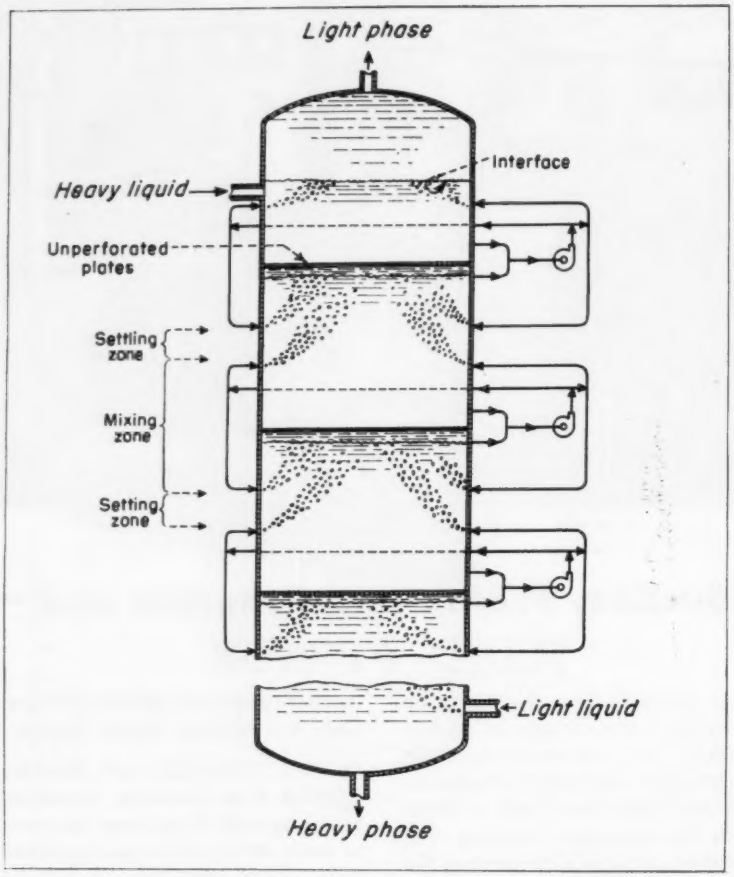
isomerization are concerned.

▶**High Efficiency, Purity**–If one mole of AgF per mole of aromatics is used, single-stage extraction efficiency is 95-100% and extract purity is 94-95%.

For best results, the feed stock should be low in both sulfur and olefin content.–**U. S. 2,713,552 by Arthur P. Lien and David A. McCaulay to Standard Oil Co. of Indiana.**




## Improved Extractor Design

**Considerable and rapid phase recycling boosts contacting efficiency in this mixer-settler extractor.**

Improved contact between phases is the principal feature of this new method for operating vertical, multistage mixer-settler extractors. How is it done? By rapid circulation of part of each settled phase into its adjacent mixing zone and back to the settling zones.

A typical example of this improved technique is illustrated above. Horizontal, unperforated plates divide the tower into a number of compartments. Flow rates of both light (dispersed phase) and heavy liquid feeds are so adjusted as to maintain a single, undisturbed interface in the top compartment.

▶**Mixing and Recycling**–Light liquid enters the bottom compartment, rises (as droplets) to the bottom of the first plate and coalesces. Most of the settled light phase is withdrawn along with some of the heavy liquid from the plate above.

These streams are mixed in a centrifugal pump, then discharged–part to the space below, part to the space above the lowest plate. This process is then repeated from plate to plate. The result: considerable recycling of both phases.

▶**Some Controls Necessary**–According to the inventor, a near-equilibrium condition is attained in each stage and only one liquid level requires control.

However, flow rates in the various recirculating pipes must be regulated to prevent reverse flow. And this can be done by using a large enough pump plus throttle valves in each pipe.

In addition to the above, the patent describes two other types of equipment which make use of the improved operating procedure.–**U. S. 2,714,056 by Noland Poffenberger to Dow Chemical Co.**

## Less Attrition in New Solids Conveyor

Here's a new scheme for conveying granular solids which overcomes, to some extent, the difficulties found in existing methods, i.e., expense and limited maximum temperature (elevators), high attrition losses (pneumatic lifts), moving parts (mass lift).

▶**Fluidized Bed**–Essentially, the procedure involves using a fluidized bed–fine, non-abrasive particles in a current of air, gas or vapor–to convey larger particles.

Material to be transported is introduced into the moving bed and both floated on and lifted by the finer particles. The overall result is

**To get any patents, including those mentioned here, order from the Commissioner of Patents, Washington 25, D. C. Each patent costs 25 cents.**

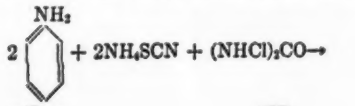
# Can AMMONIUM THIOCYANATE be used in your process?

**available in crystalline form or 50-60% solution**

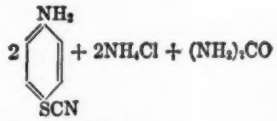
**1.** The Thiocyanate group can be introduced into many organic compounds by reaction of ammonium thiocyanate with the corresponding halide.

**2.** Thiocyanogen can be generated by the electrolysis of an aqueous solution of ammonium thiocyanate.

**3.** Aromatic thiocyanates can be prepared with ammonium thiocyanate with the aid of chloramides. The thiocyano group easily takes up the position para to the amine group, especially when one or both meta positions are vacant. If the position para to the amine group is occupied, the thiocyano group




aniline

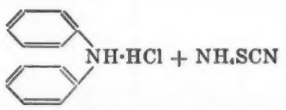



4-thiocyanoaniline

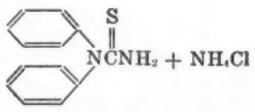
enters one of the ortho positions, but only with difficulty, with excessive heat liberation, and with the formation of a thiazole.

**4.** Some amine salts react with ammonium thiocyanate to give the corresponding amine thiocyanates.

**5.** Some amine salts yield the corresponding thioureas.




diphenylamine hydrochloride




N,N-diphenylthiourea

**6.** Guanidine thiocyanate may also be prepared in 90% yield by heating dicyandiamide with ammonium thiocyanate.

**7.** Amidines can be prepared by heating nitriles with ammonium thiocyanate at approximately 180°C.

**8.** 2-Thiohydantoins can be synthesized from acyl derivatives of α-amino acids with ammonium thiocyanate in acetic anhydride solution.

Baker Ammonium Thiocyanate is a product of synthesis stable at ordinary temperatures.* The crystalline material is soluble, clear, colorless, odorless. These advantages all contribute to economical, more trouble-free manufacturing.

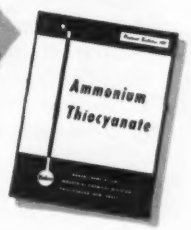
Because Baker controls all of the raw materials that go into Baker Ammonium Thiocyanate, you are always assured of uniform quality, and scheduled availability.

Baker Ammonium Thiocyanate in crystalline form is packaged in 200, 100, and 25-pound fibre drums—all polyethylene-lined. The 50-60% Solution is available in 8000-gallon tank cars. For further information, address: J. T. Baker Chemical Co., Executive Offices, Phillipsburg, N. J.

**Picks up moisture...should be kept in tightly closed containers.*

**FREE UPON REQUEST!**

Valuable Ammonium Thiocyanate Product Bulletin giving data on its properties and uses of Ammonium Thiocyanate, properties of aqueous solutions of Ammonium Thiocyanate, etc. Address your request to J. T. Baker Chemical Co., Phillipsburg, N. J.




**Baker Industrial Chemicals**

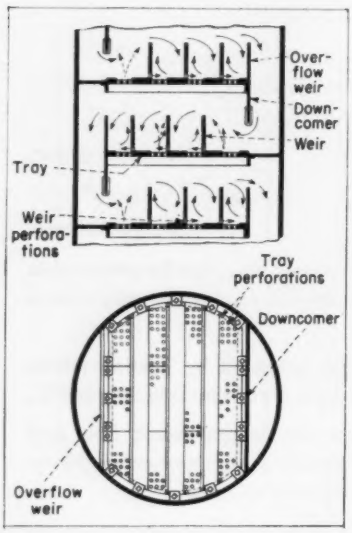
*"Purity by the ton"*

Baker CHEMICALS

one of smooth transportation and minimum attrition losses. (Superficial gas velocity is so low that, in the absence of the pneumaticized bed of fines, the gas itself cannot transport the heavier matter.)

► **Regeneration**—Once the heavier particles have been moved to the desired station, they can be separated from the fines and either regenerated, conveyed, treated or reused. Fines may be recirculated to the inlet end of the conveyor pipe.

The patent describes in detail both the operating principle and the equipment used.—**U. S. 2,712,476 by John Happel.**




## Perforated-Tray Tower Key to Better Agitation

Highlighting this perforated-tray tower design are two features:

- Smaller-than-usual gas bubbles.
- More effective liquid agitation.

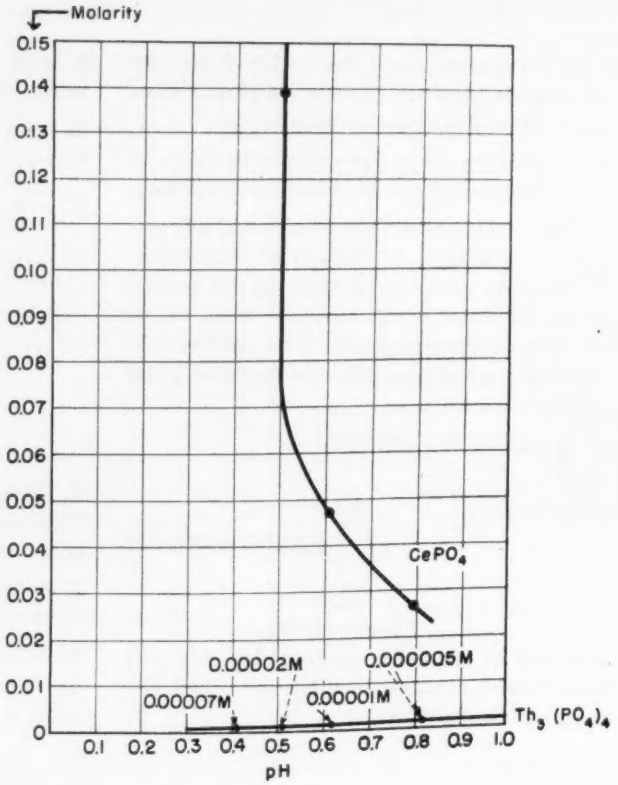
As shown, each tray is equipped —at the edge—with an overflow weir and downcomer. And, in addition, each contains a number of perforated weirs.

The weir perforations permit a small part of the liquid to flow through the weirs. The rest of the liquid flows over the weirs and is agitated by vapor passing up through the tray perforations.—**U.S. 2,713,478 by Edward G. Ragatz to Edward G. Ragatz Co.**

## New Recipe for Molded Products

Finely ground cellulosic material and thermoplastic pine wood resin are the ingredients in a new process for making molded products.

The recipe calls for (1) mixing the two materials to form a moldable mixture, (2) making a shaped felt and (3) hot pressing the felt into the molded product.—**U. S. 2,714,072 by James R. Roberts to Weyerhaeuser Timber Co.**




## Thorium, Rare Earths Separated Electrolytically

A number of recently developed recovery processes have heightened the interest in and importance of monazite sand—best source of thorium and rare earth metals.

The latest of these is one involving the electrolytic separation of thorium from other rare earths.

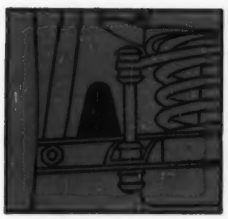
First, monazite sand (a mixture principally of thorium and rare earth phosphates) is fumed or digested with $H_2SO_4$ to bring the phosphates into solution. Next, the acid solution is diluted and filtered to remove silica and other insoluble materials. And finally, the hydrogen ion concentration is reduced electrolytically to a range within which only thorium phosphate will precipitate.

An example of how thorium can be separated from cerium is shown above in the graphic relationship between pH and solubility of the respective phosphates. (Molarities are in terms of $Ce(NO_3)_3$ and $Th(NO_3)_4$.)

It can be seen that at a pH below 0.5 sharp separation of thorium phosphate is possible.—**U. S. 2,713,554 by Edgar C. Pitzer to U. S. Atomic Energy Commission.**

# In over 100 places, Enjay Butyl rubber parts

# add to Pontiac performance

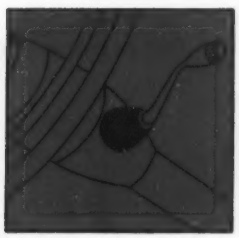


Axle bumper

Body seals, gaskets, insulators, pads, grommets, etc.

Brake and accelerator pedal pads, bellows

Radiator and heater hoses, ducts



Gearshift lever cover

Pontiac has been using parts made of Enjay Butyl since 1946. The great '56 model now incorporates more than 100 parts made from this super-durable rubber, adding to its performance, style and value. These parts have amazing resistance to deterioration and will easily last the life of the car.

Among the many advantages of Enjay Butyl are *price* and *ready availability*. And it is now available in non-staining grades for white and light-colored parts. Extensive laboratory and testing facilities are at your service. For the full story, contact the Enjay Company today.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture

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35 SUCCESSFUL YEARS OF LEADERSHIP IN SERVING INDUSTRY

# Your Checklist of New Equipment Patents

| Operation . . . | About . | Inventor or Assignee . . . | Patent No. |
|---|---|---|---|
| Crushing and grinding | Disintegrator | Joseph E. Kennedy | 2,712,902 |
| | Gyratory crusher | Axel W. Kjelgaard | 2,713,461 |
| Distillation | Fractionator | Gulf Oil Corp | 2,713,023 |
| | Lightweight fractionating tray | Socony Mobil Oil Co., Inc. | 2,714,504 |
| Drying | Rotary dryers or coolers | Link-Belt Co. | 2,713,728 |
| Extraction | Operating mixer-settler extractors | Dow Chemical Co. | 2,714,056 |
| Extrusion and molding | Wet polymer extruder | E. I. du Pont de Nemours & Co. | 2,713,698 |
| | Plastics molder | Westinghouse Electric Corp. | 2,714,226 |
| Filtration | Apparatus for making filter mass cakes | Pfaudler Co. | 2,714,349 |
| Fluid and particle flow | Solids transfer leg | Houdry Process Corp. | 2,713,949 |
| | Pneumatic conveyor | Gebruder Buhler | 2,714,533 |
| Instrumentation and control | Instrument for sensing viscosity variations | Stamicarbon N. V. | 2,712,752 |
| Solid-gas separation | Electrostatic precipitator | Research Corp. | 2,712,858 |
| | Centrifugal gas cleaner | Research Corp. | 2,712,859 |
| | Mechanical dust collector | Research Corp. | 2,713,920 |
| Solid-solid separation | Froth flotation machine | Paul L. Wigton | 2,713,421 |
| | Separation of solids differing in specific gravity | Stamicarbon N. V. | 2,713,945 |
| | Elutriator | Sec. of the Army | 2,714,453 |

# . . . And New Process Patents

| Product . . . | Process . . . | Inventor or Assignee . . . | Patent No. |
|---|---|---|---|
| Carbon | Increasing yields of tar-free carbon black | Phillips Petroleum Co. | 2,714,055 |
| | Preparing activated carbon | Esso Research & Engineering Co. | 2,721,184 |
| Fats and oils | Continuous refining of glyceride oils | Phillips Petroleum Co. | 2,714,114 |
| | Processing alkyl esters of fatty acids | Emery Industries, Inc. | 2,714,603 |
| Fuels | Preparation of oil gas | Gas Machinery Co. | 2,714,058 |
| | Fuel gas production | Phillips Petroleum Co. | 2,714,059 |
| Gases | Storage of natural gas on a solid absorbent | J. F. Pritchard & Co. | 2,712,730 |
| | Air separation | Linde's Eismaschinen A. G. | 2,712,738 |
| | Acetylene production | Union Oil Co. | 2,713,601 |
| | Low-temperature separation of natural gas | Mississippi River Fuel Corp. | 2,713,780–1 |
| | Thermal preparation of oil gas | Institute of Gas Technology | 2,721,122 |
| | Acetylene manufacture | Stanolind Oil & Gas Co. | 2,721,227 |
| Inorganic chemicals | Nonelectrolytic production of chlorine and ammonia | Chemical Foundation, Inc. | 2,714,550 |
| Metals and ores | Continuous feeding of electrolytic aluminum cells | Montecatini | 2,713,024 |
| | Photochemical separation of mercury isotopes | Baird Associates | 2,713,025 |
| | Metallic titanium production | Horizons Titanium Corp. | 2,714,575 |
| | Distillation of metals | Broken Hill Associated Smelters Proprietary Ltd. | 2,720,456 |
| | Titanium base alloys | Allegheny Ludlum Steel Corp. | 2,721,137 |
| Organic chemicals | Carbon bisulfide production | Dow Chemical Co. | 2,712,982–5 |
| | Production of benzene hexachloride containing enhanced gamma isomer content | Columbia-Southern Chemical Corp. | 2,713,076 |
| | Ethylene oxide from ethylene | Ethyl Corp. | 2,713,586 |
| | Amino acids production | International Minerals & Chemical Corp. | 2,713,592 |
| | Acetaldol from acetaldehyde | Les Usines de Melle | 2,713,598 |
| | Production of tertiary aromatic alcohols | Hercules Powder Co. | 2,713,599 |
| | Preparation of isopropyl benzene hydrocarbons | California Research Corp. | 2,713,600 |
| | Production of acetoacetic acid amides | British Industrial Solvents Ltd. | 2,714,117 |
| | Halohydrins production | Shell Development Co. | 2,714,121 |
| | Dichlorohydrins production | Shell Development Co. | 2,714,122–3 |
| | Manufacturing octachlorocyclopentene | Hooker Electrochemcal Co. | 2,714,124 |
| | Preparation of 2, 4, 5-trichlorobenzyl chloride | C. H. Boehringer Sohn | 2,714,125 |
| | Producing oxygenated hydrocarbons | Celanese Corp. of America | 2,714,604 |
| | Production of nitrous esters | Samuel Soloveichik | 2,714,606 |
| | Separating 4- and 5-nitroanthranilic acids | E. I. du Pont de Nemours & Co. | 2,714,612 |
| | Anhydrous formaldehyde production | Celanese Corp. of America | 2,714,616 |
| | Manufacturing chlorofluorocarbons | Allied Chemical & Dye Corp. | 2,714,618 |
| | Refining tall oil | Alfred M. Thomsen | 2,720,515 |
| | Extractive distillation of *o*-xylenes from a petroleum fraction | Sinclair Refining Co. | 2,721,170 |
| | Production and separation of polycarboxylic acids | Union Oil Co. of Calif. | 2,721,190 |
| Resins | Producing modified alkyd resins | American Cyanamid Co. | 2,713,039 |
| | Making formolite resins | Pan American Refining Corp. | 2,713,571 |
| Rubber | Reclaiming natural and synthetic rubber with bis (tetraalkylphenols) | Firestone Tire & Rubber Co. | 2,713,561 |
| | Rubber vulcanization | Wyandotte Chemicals Corp. | 2,713,572 |
| | Solvent for reclaiming vulcanized rubber | Edward A. Van Valkenburgh | 2,714,071 |
| | Manufacture of synthetic rubber | Phillips Petroleum Co. | 2,720,510 |
| Synthesis gas and products | Synthesis of organic cpds. | The M. W. Kellogg Co. | 2,700,676 |
| | Hydrocarbons oxidation | Celanese Corp. of America | 2,700,677 |
| | Desulfurization of oxo alcohols | Standard Oil Development Co. | 2,700,687 |
| | Manufacture of synthesis gas | The Texas Co. | 2,701,756 |
| | Manufacture of synthesis gas | Texaco Development Corp. | 2,701,757 |
| | Catalytic hydrogenation of oxo aldehydes | Esso Research & Engineering Co. | 2,713,073 |
| | Aluminum alcoholate reduction of oxo aldehyde mixtures | Esso Research & Engineering Co. | 2,713,074 |
| | Metal oxide treatment of oxo alcohols | Esso Research & Engineering Co. | 2,713,075 |
| | Liquid organic cpds. from coal | M. W. Kellogg Co. | 2,713,590 |
| | Hydrocarbon oils and coke from chemically modified coal | Erwin Bluemner | 2,714,086 |
| Synthetic fibers | Viscose rayon production | Textile & Chemical Research Co. Ltd. | 2,699,983 |
| | Dyeable acrylonitrile filament-forming copolymer | Allied Chemical & Dye Corp. | 2,700,034 |
| | Washing a gelled thread of acrylonitrile | American Cyanamid Co. | 2,714,052 |
| | Bleaching acrylonitrile fibers | E. I. du Pont de Nemours & Co. | 2,720,440 |
| Waxes | Deoiling wax cakes | Esso Research & Engineering Co. | 2,713,022 |

# for lower cost control of moderately **Corrosive** fluids

Fig. 2651-A Gate

**JENKINS**

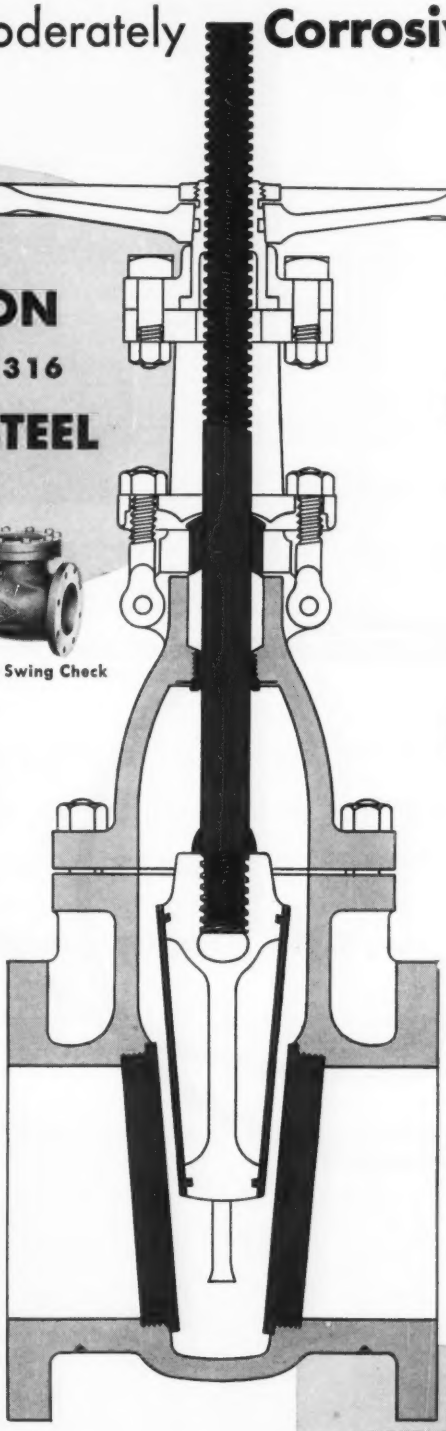
## NICKEL IRON

**Valves with Type 316**

## STAINLESS STEEL

**Trim**

Fig. 2624 Swing Check



This combination provides corrosion resistance well above the moderate need in many processing services with an investment well below that for all-stainless steel valves.

Designed primarily for the chemical process industries, they are recommended for control of mildly corrosive liquids with minimum quantities of mineral acids, such as creosote in wood treatment, and many liquids carried in petroleum processing.

A major use is in pulp and paper processing, particularly in lines serving the digester, and in the chemical recovery cycle. Service records in lines carrying the valve-punishing "black liquor" give Jenkins Nickel Iron Valves top performance rating.

Jenkins *extra value* construction throughout. Get details — compare. See why they stretch your valve investment dollar — with longer service life, lower maintenance cost.

***Every part in contact with fluid is the right metal to block corrosion and beat wear.***

**Cast NICKEL IRON**

- **BODIES** Heavy duty, dimensioned for greater resistance to wear and abuse. Through port design in Gate Valves.
- **BONNET** Rugged construction, like body. Swing-type gland bolts. Screwed-in back-seating bushing. Deep stuffing box.
- **YOKE** Integral with bonnet in 2″ to 4″ sizes.
- **WEDGE** In 10″ to 24″ sizes, with Stainless Steel Wedge Rings.
- **COVER** In Check Valve.

**Type 316 STAINLESS STEEL**

- SPINDLE
- GLAND
- BONNET BUSHING
- SPINDLE RING
- WEDGE PIN
- WEDGE RINGS Rolled into Nickel Iron Wedge in 10″ to 24″ sizes.
- SEAT RINGS
- DISC and HANGER in Check Valve

**NI-RESIST Type No. 2**

- WEDGE of I-beam structure is solid NI-RESIST in 2″ to 8″ sizes.

**PRESSURE RATINGS**

2″ to 12″—200 lbs. O.W.G.
14″ to 24″—150 lbs. O.W.G.

ALSO RECOMMENDED for fluids used in electroplating, photograph finishing, textile bleaching, dyeing and finishing and heat treating of metals.

**GET COMPLETE SPECIFICATIONS from your Jenkins Valve Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17. Ask for Bulletin 118.**

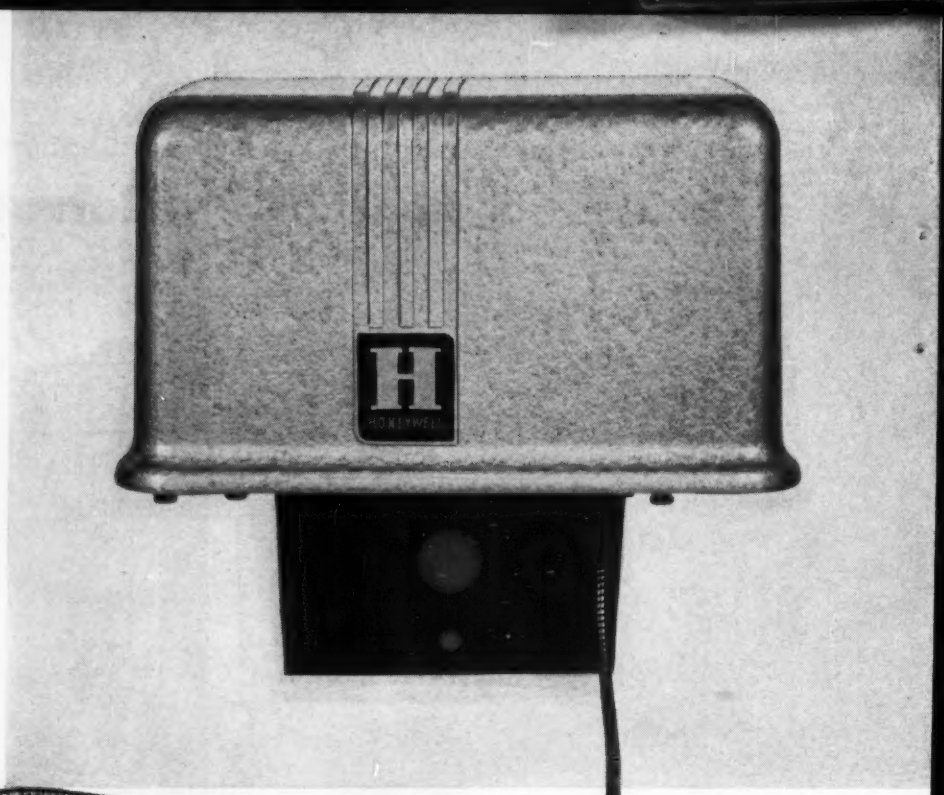
JENKINS VALVES

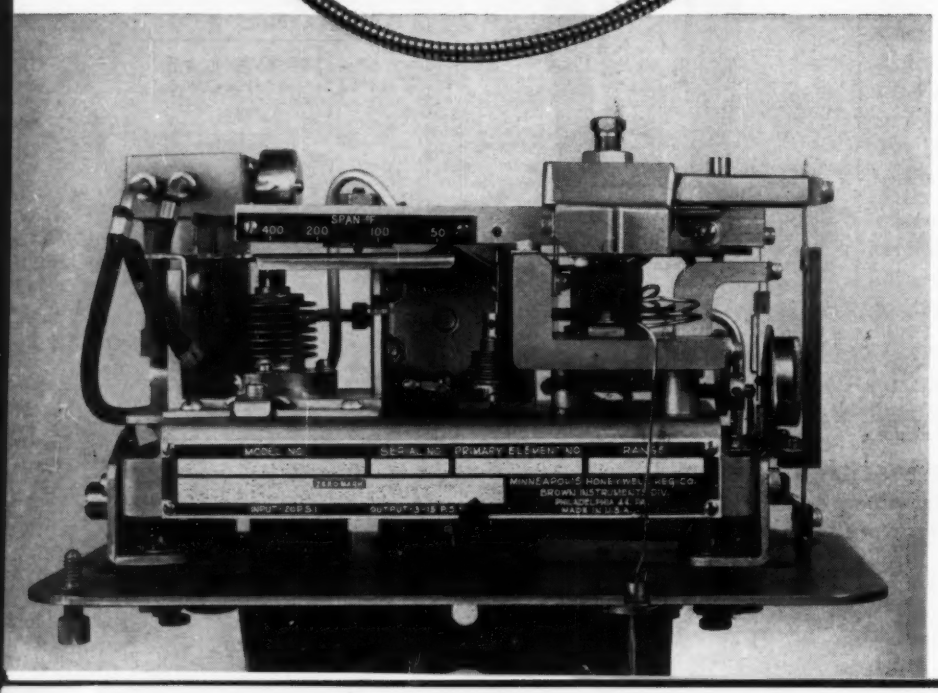
LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

The *Tel-O-Set* transmitter is housed in a rugged, weather-resistant case, only 6½" by 11¾" by 6¾". It is readily mounted in the field . . . on pipe, wall, or horizontal well.




*Interior view of the transmitter with cover removed shows the simple, sturdy force-balance mechanism. Span and zero adjustments are easily accessible . . . require no changes of parts.*

# Compare it!

## The same *Tel-O-Set* Transmitter can be used for temperature, absolute pressure or gage pressure—in all ranges

Changeover is simple...takes little time and labor. And, there's no need to stock an assortment of thermal systems or spring assemblies.

## Tops in performance, too...

In accuracy • In speed of response • In ambient temperature and pressure compensation • In resistance to vibration • In durability • In ease of adjustment and calibration • In operating economy

Span can be adjusted to any values between 20 psi or 50 F minimum, and 150 psi or 400 F maximum. Without changing parts, the span can be shifted to cover any part of the overall transmitter range . . . from −375 to + 1000 F, or from 40 to 550 psi.

This multi-purpose instrument will simplify the training of your operating and maintenance men . . . reduce spare parts inventory. And a single instrument does double duty as a standby replacement for either temperature or pressure applications. Its sturdy, corrosion resistant mechanism assures long service life.

Your local Honeywell sales engineer will be glad to discuss how the *Tel-O-Set* transmitter . . . and related *Tel-O-Set* miniature indicators, recorders and controllers . . . can work for you. Call him today . . . he's as near as your phone.

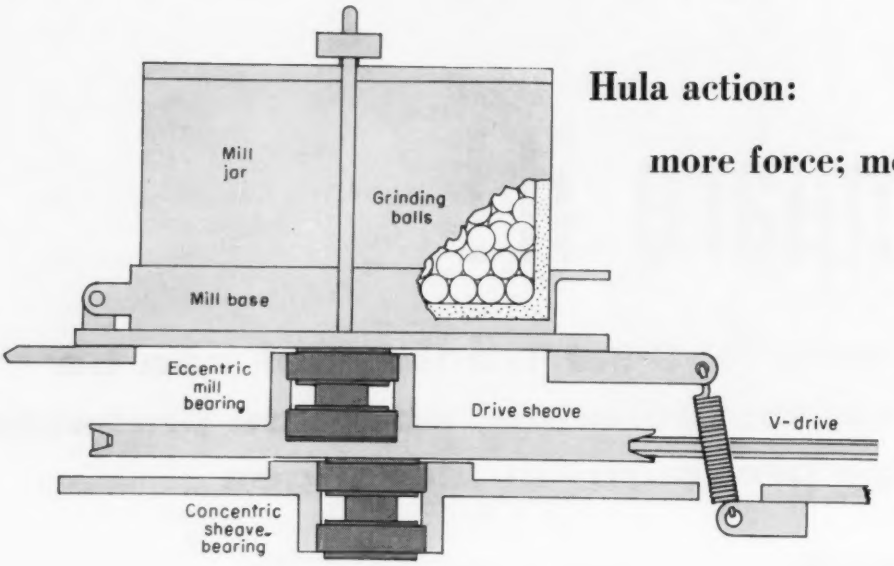
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:** Write for Bulletin 7280, "*Tel-O-Set* Transmitters."

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

*First in Controls*




**Hula action:**

**more force; more capacity**

# Gyration Speeds Ball Mill Grinding

**Capacities four to seven times greater than usual are reported for a vertical, nonrotating gyrating ball mill. Unit operates batch or continuous, wet or dry.**

When the balls in a conventional ball mill start hugging the wall for a complete revolution, critical speed of the mill has been exceeded. Then grinding rate drops sharply. It proves that centrifugal force beyond a bare minimum is a hindrance rather than a help in operation of such mills.

The gyratory ball mill, just becoming available commercially, turns centrifugal force into a help rather than a hindrance. Through this turnabout, capacity is actually four to six times that of the conventional mill. And the mill is easier to feed, discharge and service.

Boost in capacity may be particularly significant where ceramic grinding balls must be used. Because they have relatively low specific gravity such media grind at slow rates. But with the gyratory action of the new mill, ceramic balls actually grind faster than steel balls in a conventional ball mill.

▶**Gyrates Without Rotating**—The cylindrical gyratory mill is mounted with the axis in a vertical position. The drive mechanism gyrates or swings the mill in a circle. Coil springs prevent the mill from rotating while still permitting it to gyrate in a perfect circle.

Mechanical design of the mill is relatively simple. Loads are carried by anti-friction bearings. There are no gears. Mill is driven by a vertical ball-bearing motor, V-belts and pulleys.

▶**Three Important Variables**—Ball action within the mill depends upon the relationship existing between three variables: ball load as percent of mill volume, radius of gyration and frequency of gyration. Balance between these three variables may produce one of three different conditions of ball action.

In the first condition a single ball races or rolls around the wall of the mill when the mill operates at a certain speed and radius of gyration. Ball makes one complete cycle with each gyration of the mill. Under this condition the weight of the single ball may be increased many fold.

When the mill contains a mass of balls they may be fluidized so that they flow around the wall under centrifugal pressure. The action is similar to a rock slide, so that the action of individual balls is unlike that prevailing with a single ball in the mill. Energy to produce this condition is high.

If the ball load is increased to 70% of mill volume, the radius of gyration decreased and the speed increased the load swells to completely fill the mill. No longer does the load race or flow. Individual balls become highly energized and beat violently against each other.

Highest grinding potency (gm. ground per min. per 1,000 gm. of

# how to avoid the high cost of

## *Repairs and Service Interruptions*

Records over the past ten years show that LaBour PACKINGLESS Type G pumps in chemical service cost little or nothing—yes, nothing—for repairs. (There are Type G's running with all original parts after as much as seven years of service. A figure of a dollar or two per month per pump for repair parts is not uncommon.)

This means, of course, that time out for repairs is also at a minimum, as is the cost of labor for making the repairs.

So if pump service costs are running high in your plant, the logical answer to your problem is LaBour Type G. The new CG handles flooded suction as well as suction lift applications, so this economy is available in a wide range of services. Ask for Bulletin G-1.

**ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP**

# LABOUR

**THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.**

## Newsworthy Equipment This Month


**Equipment Cost Indexes, p, 254**

**New Processing Equipment**
- Gyration Speeds Grinding....252A
- Vibrating Screen....254A
- Automatic Autoclaves....256A
- Tablet Coater....256B
- Extractor....256C
- Ultrasonic Processing....256D
- Tubular Filter....256E
- Porous Stainless Steel Filter Elements....258A

**New Heating & Cooling Equipment**
- Heat Exchanger....260A
- Magnetic Cooler....260B
- Plastic Siding For Cooling Towers....260C
- Cooler....260D

**New Electrical & Mechanical Equipment**
- Shaft Seal....262A
- Breather....262B
- Press Closer....262C
- Heavy-Duty Engine....262D
- Exhaust Purifier....262E

**New Fluids Handling Equipment**
- Welded Tubing....264A
- High Pressure Pumps....264B
- High Temperature Pump....264C
- Armored Pipe....264D
- Modular Tank Elements....264E

**New Instruments & Controls**
- Controller....266A
- Control....266B
- Temperature Control....266C
- Level Indicator....266D
- Flowmeter....266E

**New Maintenance Tools & Supplies**
- Die Lubricator....268A
- Gamma Ray Projector....268B
- Expander Control....268C
- Valve Covers....268D
- Resistant Clothes....268E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balls) is obtained under the condition producing the greatest centrifugal effect, i.e. the first condition. Next in potency is the second condition.

Radius of gyration can be adjusted from ½ the diameter to any smaller radius. The size of particle that can be crushed, the capacity of the mill and the power consumed are related to the number of gyrations per min. Three hundred gyrations per min. are about right for most grinds.

▶**Batch or Continuous**–To load the mill for batch operation the cover is removed and the charge poured in. After milling the cover is removed and the mill tilted about its hinge to dump the load.

Mill can operate continuously with ease because the small radius of gyration permits easy feeding and discharging. The cover is fitted with a cylindrical hopper with diameter substantially greater than the radius of gyration so that a feed pipe can be inserted below the top of the hopper. A grate guards the opening through the cover to retain the balls.

A discharge spout attached to the side of the cylindrical wall has the end fitted flush with inner wall surface. Guarded by a grate the spout height determines the level of pulp within the mill.

For fine dry grinding, the same mill may be swept with air to remove finished product. Size of product is a function of the air volume sweeping through the mill.

▶**Now on the Market**–Since the gyratory ball mill has only recently become available it is being built only in small sizes. The 6, 8 and 12 in. mills are interchangeable on the same base structure. Similarly the 18 and 24 in. sizes are interchangeable. The 24-in. size holds a 500-lb. ball charge.

An attempt to compare cost of the Fahrenwald Gyratory ball mill with conventional ball mills might be made on the basis of weight per unit of capacity. With a 4 to 1 capacity advantage the Fahrenwald mill should cost proportionately less without even considering the added effect of simpler mechanical design.–**General Machinery Co., Spokane, Wash.** **252A**

## Equipment Cost Indexes

| | June 1955 | Sept. 1955 |
|---|---|---|
| **Industry** | | |
| Avg. of all | 188.1 | 191.0 |
| **Process Industries** | | |
| Cement mfg. | 180.2 | 182.8 |
| Chemical | 189.0 | 191.3 |
| Clay products | 175.0 | 177.6 |
| Glass mfg. | 178.6 | 181.2 |
| Paint mfg. | 181.9 | 184.6 |
| Paper mfg. | 182.2 | 184.9 |
| Petroleum ind. | 185.6 | 188.3 |
| Rubber ind. | 188.0 | 190.8 |
| Process ind. avg. | 186.1 | 188.9 |
| **Related Industries** | | |
| Elec. power equip. | 190.8 | 193.6 |
| Mining, milling | 189.9 | 193.0 |
| Refrigerating | 208.7 | 211.8 |
| Steam power | 178.1 | 180.7 |

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1955, pp. 178-9 for annual averages since 1913.

## Vibrating Screen

**Runs at high speed to increase capacity.**

Screening rates and efficiencies are said to be greater with a screen, now available, that vibrates at 3,600 cycles per min. In this manner screen size is reduced and less expensive cloth is needed.

Screen is operated by a totally enclosed vibrating motor so there are no belts, sheaves or external

Laboratory Model T-20 Exolon High Intensity Magnetic Separator for quick evaluation of the possibilities of magnetic separation.

Laboratory Model T-25 Exolon High Intensity Magnetic Separator, the ultimate in laboratory machines for results directly comparable with the commercial sized models.

NEW

## LABORATORY EQUIPMENT FOR DIFFICULT

# MAGNETIC SEPARATION

Specially designed for separating dry, granular, weakly magnetic materials or those materials usually considered non-magnetic.

Material in a grain stream flows onto the highly magnetized revolving rotor. The particles in the stream, which are influenced by magnetism, cling to the rotor longer than the non-magnetic particles. Knife-edge dividers are so placed as to make the desired separations of the head feed.

Designed by the manufacturers of the Exolon High Intensity Magnetic Separators, which have been proven in many fields.

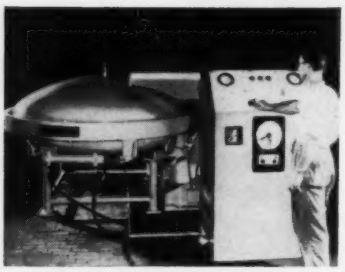
**For Further Information Write**

**THE EXOLON COMPANY** 951 E. NIAGARA ST. TONAWANDA, N. Y.

**See Our Exhibit At The Chemical Show — Booth 609!**

motor mounts. Use of rubber float mountings absorbs most of the vibration.

Sizes run 18, 24 and 36 in. wide in lengths from 4 to 8 ft. Special hoppers and dust-tight covers can be fabricated to satisfy job requirements.—**Derrick Mfg. Co., 1754 Walden Ave., Buffalo 25, N. Y.** 254A



## Automatic Autoclaves

**Started by push button, operate without attendance.**

Autoclaves newly offered for processing materials such as rubber and plastics feature true push-button operation. Once the cycle is started by pushing a button all steps are controlled automatically. One man and a helper can operate as many as eight of these autoclaves.

The automatic instruments control both heating and cooling during the curing and cooling cycles and furnish a written record of the complete cycle. Lid of the autoclave is raised, lowered and locked by a hydraulic mechanism—**Philips & Davis, Inc., Kenton, Ohio.** 256A

## Tablet Coater

**Applies dry protective coating to tablets.**

While it may be desirable to coat many tablets, the conventional pan coating method may be unsuitable because the moisture damages active ingredients. Now, a new machine compresses dry powder around the core tablet of active ingredient. Such dry coated tablets have been found, on use, to disintegrate more rapidly than pan-coated tablets.

Tablets up to ½-in. dia. can be coated at rates up to 500 per min. The core tablet is held to a concentricity of plus or minus 0.005 in. within the finished tablet.

Coating powder is fed to the die by two hoppers; the core tablets are fed in bulk by a separate feeder. Imperfect tablets such as those that do not contain a core tablet are rejected by an electrical sensing device.—**F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.** 256B

## Extractor

**Handles 500 gpm. of difficult to extract materials.**

A recent addition to the Podbielniak line of centrifugal counter-current extractors is a giant that handles 500 gpm. combined streams. Original unit was built for chemical extraction system having difficult mixing and separating characteristics. It would take a 10 ft. gravity column 100 ft. high to do the same job as this 42 by 42 in. machine.

Rotor is constructed entirely of Type 316 stainless steel. Although unit operates at 2,000 rpm. it is balanced to rotate without vibration. The heavy duty roller bearings are lubricated by a forced feed system to keep maintenance at a minimum.—**Podbielniak, Inc., 341 East Ohio St., Chicago 11, Ill.** 256C

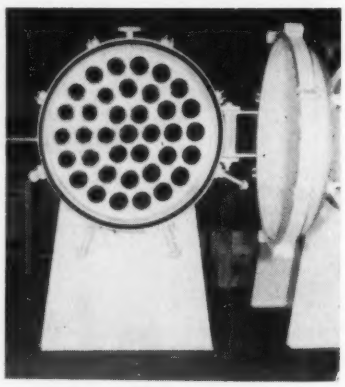
## Ultrasonic Processing

**Opened up by new low-cost, high-frequency generator.**

The barrier of high cost for ultrasonic processing is reported breached by a new low-cost, high-frequency rotating generator. It means favorable laboratory work based on ultrasonics now can be translated into full scale plant production.

For example, a 5 kw. generator driven by a 15 hp. motor will energize up to 10 submersed 400-w. transducers of any type. Each transducer will produce copious cavitation throughout a large volume of the solution. Explosive forces of several hundred atmospheres produced thereby can speed up processing to give more uniform results at lower temperature on many applications.

Surface tension is destroyed and chemical activity accelerated. Beneficial results can be obtained in polymerization, emulsification, dispersion, particle size reduction, agglomerization and agitation of difficult liquids such as molten brine.—**Acoustica Associates, Inc., Glenwood Landing, L. I., N. Y.** 256D



## Tubular Filter

**For simple, low-cost filtration of small volumes.**

An unusual flow pattern provides simplified operation and very low maintenance in a new line of tubular filters. Several tubular elements are housed within one chamber. The liquid enters individual tubes, then passes through filter paper and perforated tube wall into the chamber.

Filter is cleaned by removing the used liners. Rolled flat sheets of filter paper are inserted to replace them.

Units are particularly effective polishing liquids containing a low percentage of solids, trapping solids not caught by other clarification equipment and filtering run-off from cleaning or servicing of larger filters.

Units available have from 1 to 36 tubes with filtration areas from 2.4 to 86.4 sq. ft.—**Industrial Filter & Pump Co., 5904 Ogden Ave., Chicago 50, Ill.** 256E

# "Used many makes of turbines... PREFERS COPPUS"

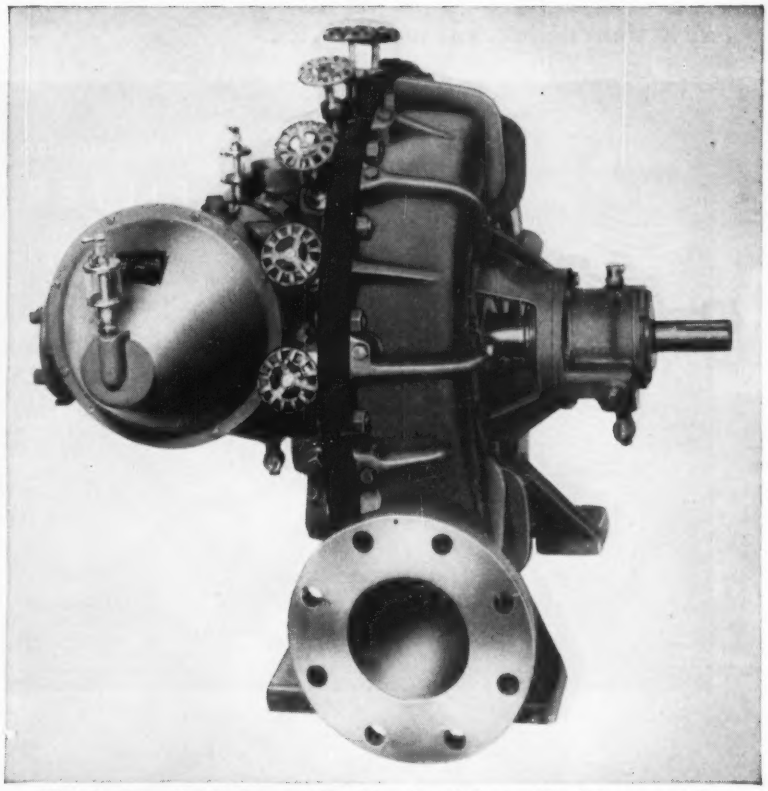
If you want to know about turbine performance, ask an *operator*. He *knows*. And, in the words of one of them:

> "I have had occasion in the past to operate many makes of turbines. The plant in which I am now employed is almost entirely Coppus equipped on our auxiliary equipment. I find your turbines most satisfactory and would like to congratulate you on your design."

Whether you use a Coppus with a regular wheel or wide bucket "L" type you get these *proven* features:

- Turbines rated close to your hp requirements from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
- Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes, *make turbine dollars go farther*. Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION
232 Park Avenue, Worcester 2, Mass.
Sales offices in THOMAS' REGISTER



*This is the reliable Coppus Turbine furnished with either a regular wheel or wide bucket "L" type wheel.*

*This wide bucket "L" type wheel is a new development for use where low water rate is essential.*

*This is the regular wheel used on Coppus Turbines which have been so highly satisfactory throughout industry.*

**COPPUS "BLUE RIBBON" TURBINES**

# New Media Widen Filtration Range

FACED with an increasing number of filtration problems under difficult conditions Cuno has added Poro-Klean porous stainless steel elements to its filter line.

Available in various grades of stainless steel these elements resist most corrosive action, and temperatures above 1,000 F. They can be built to handle very viscous fluids at differential pressures in excess of 2,000 psi.

Poro-Klean elements fit the Micro-Klean line of housings now widely used with throwaway filter cartridges. Cuno expects the Poro-Klean elements to operate mainly above 275-300 F. and 75 psi. operating pressure differential.

These porous metallic elements can be cleaned for reuse over an indefinite number of filtration cycles. Being metal, they can be sterilized. And because there are no fibrous components they assure a filtrate entirely free of any fibrous contaminants.

▶**Now on the Line**—Although widespread availability of Poro-Klean elements is just being announced they have been building operating records for over a year on some installations.

In a petroleum refinery catalyst fines are being filtered from a 150 gpm. naphtha stream at 400 F. in a 700 psi. ASME–API vessel. Filter surface is cleaned by a periodic gas blowback with the drain line open.

Highly viscous polymer in a plastics plant is clarified above 500 F. under a driving force of more than 2,000 psi. And a chemical manufacturer has built Poro-Klean elements into a reactor to clarify the discharge stream. Elements are backflushed periodically with 150 psi. steam.

▶**Powder to Sheet**—Porous stainless steel in the Poro-Klean elements is made by sintering alloy powders in a specially designed furnace. Before sintering the powders are carefully graded to a uniform particle size. On emerging from the furnace the porous sheets are inspected and checked for pore size, pore size distribution and flow capacity.

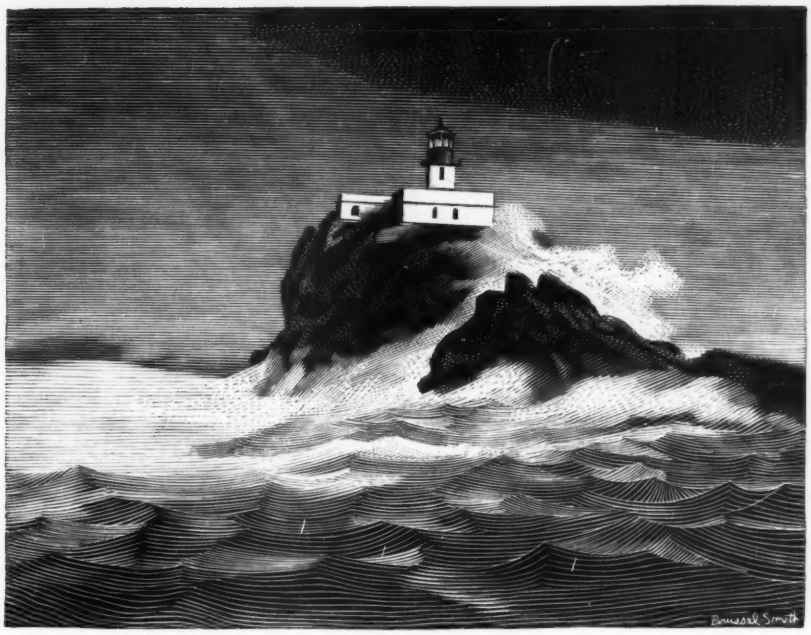
The porous sheet is fabricated into two standard elements—a 2-sq. ft. cell type that looks like a stack of washers on a bolt, and a 0.6-sq. ft. cylinder type.

Choice between the two elements is determined by operating conditions for a given application; retention characteristics can be selected over an approximate range of 2 to 40 microns. Of course, a housing is selected that will hold the number of elements needed to give the required total feet of filter area.

Where you require a tailored unit, Cuno has had wide engineering experience in designing special sizes with either cell or cylindrical configurations to give the needed filter area.

Fabricated elements are welded by the Heliarc fusion method that avoids oxidation and preserves initial properties of the metal. In some cases, end use may dictate that the powder be preformed to final shape before sintering. Only smaller units can be manufactured by this method.—**Cuno Engineering Corp., Meriden, Conn.** **258A**

FAMOUS LIGHTHOUSES OF AMERICA



*TILLAMOOK ROCK LIGHTHOUSE is one of the most unusual on the Pacific Coast. Built in 1881, it is a stone structure standing on a small rock islet one mile off shore at Tillamook Head, Oregon. Because of its exposed position, in deep water and open to the sweep of the Pacific, it has received many violent batterings from stormy seas. Occasionally waves break completely over the lantern itself, 133 feet above sea level. Landing is made only by hoisting from a boat.*


***Freedom From Risk*** in the choice of electrochemicals is provided by Niagara Alkali Company's modern production facilities and by its extremely rigid quality control methods. Rely on Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride).

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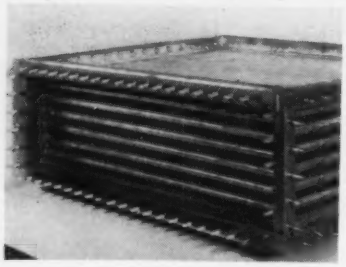


### Heat Exchanger

**With corrugated design for gas-to-gas service.**

Designed primarily for gas-to-gas service the Plate Fin exchanger is a compact cross-flow unit with extended surface on both sides. With 150 sq. ft. of heat transfer surface per cu. ft. of exchanger it is comparable spacewise to a tubular exchanger with tightly packed ¼-in. tubes. However, it costs much less.

Individual cell has three simple parts: the corrugated sheet, the formed and butt-welded flat tubes, and the blanked and extruded sheet-metal tube sheets. Tubes are formed from flat sheet metal with a 180 deg. semi-circular bend at one edge and a longitudinal butt weld at the other edge. Tube sheets are sheet-metal stampings with extruded tube hole lips to which the tubes are edge welded.

As currently designed, cells are suitable for 100 psi. on either or both sides; gas temperature to approximately 1,100 F. on either or both sides. Exchanger can be made of mild steel, low alloy steel or special materials such as stainless steel or Inconel.—**Griscom-Russell Co., Massillon, Ohio.** 260A

### Magnetic Cooler

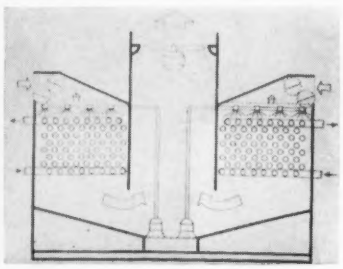
**Maintains temperature close to absolute zero.**

A new type refrigerating machine is said to be the first apparatus able both to produce extreme low temperatures and to maintain them for long periods of time. Based on a cyclic principle of magnetic cooling it is believed to represent the first commercial application of the superconductivity phenomenon.

There are no moving parts or flowing fluids in this cooling system. Instead there is a plastic capsule 3-in. long, containing a special chemical salt as the refrigerant. Operation of the refrigerator is controlled entirely by external magnetic fields.

While not giving a clear explanation of how the machine operates the backers do say that superconductivity plays a key role. Metals that are superconductive lose all resistance to flow of electric current at very low temperatures and at the same time act as thermal insulators. When not in the superconductive state they conduct heat.

For now, the refrigerating machine is slated for experimental duty on the study of the basic laws of matter.—**Arthur D. Little, Inc., 30 Memorial Dr., Cambridge, Mass.** 260B



### Cooler

**Cools process fluids within 2 deg. of desired temperature.**

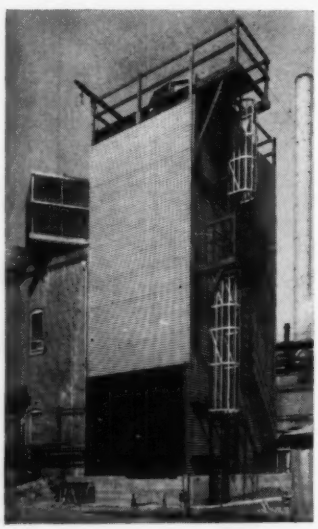
For process cooling jobs the new Panel Casing Aero heat exchanger controls temperature within 2 deg., yet consumes less water. It cools by evaporation, modulating the use of outside air to control temperature.

Fluid to be cooled, either liquid, compressed air or gas, flows through two parallel-mounted coil sections. Water spraying on the coils evaporates into the air streaming over them. Drainage from the coils is recirculated.

Air enters through dampered intakes above the coils, moves downward through the sprays and coils. At the bottom the air stream reverses direction.

Heat load varies the air intake dampers to control evaporation and hold temperature to the desired point without "hunting action."

Four sizes of this unit afford capacities from 7 to 18 million Btu. per hr. under standard conditions. —**Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y.** 260D

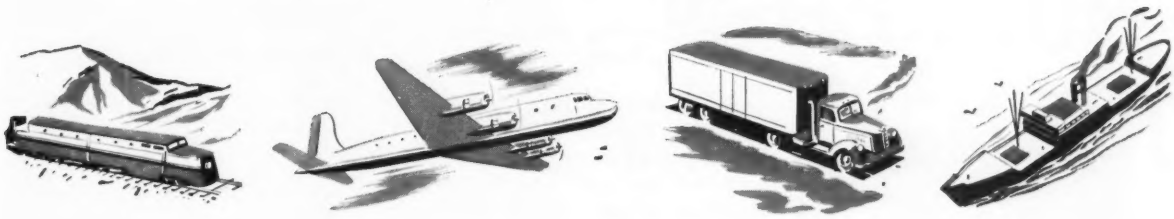


### Plastic Siding Makes Debut on Cooling Tower

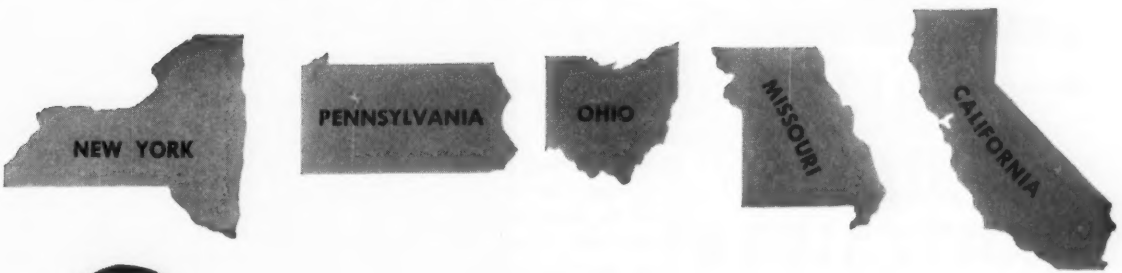
**This cooling tower installed recently at the South Texas Cotton Oil Co., Houston, has siding fabricated of corrugated asbestos-plastic composition. Tower is tied in to new high-vacuum deodorizing unit at this crude-cotton-oil refinery. While it is too early to boast of performance some obvious advantages are light weight and imperviousness to rot and mold. Since the siding is translucent, light penetrating the tower will make easier the work of cleaning and repairing.—The Fluor Corp., Los Angeles 22, Calif.** 260C

## For fibre drums of any size, style or design . . .

## for safe, economical delivery of your product . . .



## for fast supply service from conveniently-located plants . . .



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## Shaft Seal

**For high temperature service.**

A new rotary mechanical shaft seal is designed to handle hot oils or water up to 800 F. Design is simple and easy to install on new or existing equipment, allows for thermal expansion to assure efficient performance.

Construction is generally stainless steel with durable wearing faces. Seals have stainless steel U-ring shaft packings.

Flushing of the stuffing box is not required other than to control vapor pressure in the box, or to flush out any excessive coke formed under high temperature.—**Duralmetallic Corp., Kalamazoo, Mich. 262A**

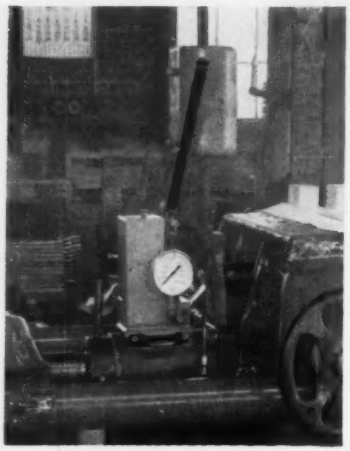
## Breather

**Boosts air flow through explosion-proof housings.**

Flow of ventilating air through explosion-proof housings is tripled or quadrupled by the new, stainless-steel universal breather and drain. It is shown in position on the combination explosion-proof starter and circuit breaker above.

New breather not only ventilates the housing to minimize condensation but also drains off accumulated water resulting from condensation. Large air passages prevent clogging by dust or small dirt particles.

Units can be installed by screwing them into hubs or holes tapped for conduit having five or more threads. This assures complete safety since at least five threads will be engaged.—**Crouse-Hinds Co., Wolf and Seventh North St., Syracuse, N. Y. 262B**



## Press Closer

**For existing presses, operates hydraulically.**

Work for closing filter presses is minimized through use of the Handraulic closing device. This manually operated hydraulic device provides a high power-to-work ratio with maximum pump leverage and pressure gage control.

The Handraulic closer can be installed on existing presses without alterations, re-boring or removal of any plates. It replaces the filler block and is locked in position with the slide head by the cap screw provided. The original manual closing device remains in position as a stand-by unit.

During cleaning, the Handraulic device swings horizontally out of position to allow the slide head to be moved back. Result is maximum working space for cleaning the filter press.—**D. R. Sperry & Co., Batavia, Ill. 262C**

## Heavy-Duty Engine

**For continuous service in chemical and petroleum plants.**

Now available in ratings up to 1,400 hp. is the completely new W9 medium-speed heavy-duty engine. It is extremely compact with a low weight per horsepower ratio, yet retains great structural strength. Engine is adaptable for both stationary and portable use.

Most modern and unique feature of engine is "Jet-Swirl" turbocharged power. Air inlet is streamlined to bring air in parallel to the inlet valve stem giving it a swirl as it enters the cylinder. By this method larger and more turbulent charges of air are rammed into the cylinder giving cleaner and more complete combustion.

The W 9 engine operates on low-cost fuels such as residual, crude, and distillate oils; natural, sewage, propane or manufactured gas.

Power can be taken off from either end of the engine. Choice of power take-off equipment can be made from wide selection of standard clutches, hydraulic couplings and torque converters now on the market.—**Worthington Corp., Harrison, N. J. 262D**

## Exhaust Purifier

**Can handle leaded gasoline exhaust.**

Further progress has been made in the fight on fumes from industrial trucks with announcement of the Oxy-Muffler for gasoline-powered trucks. Device is claimed to be the first catalyst exhaust purifier that can be used on leaded gasoline.

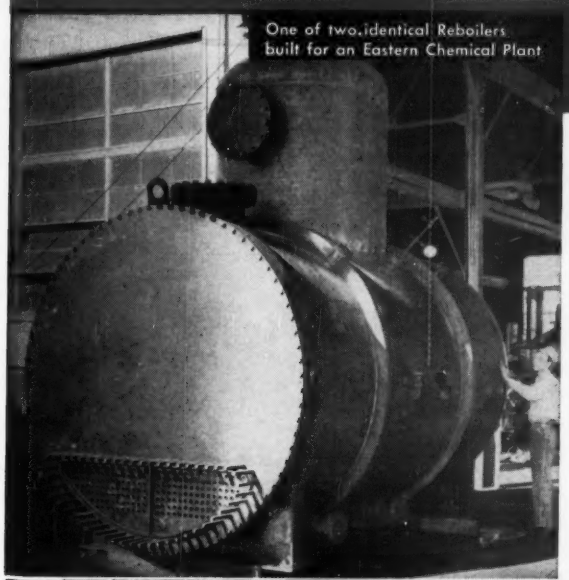
The Oxy-Muffler removes by catalytic burning as much as 90% or more of the carbon dioxide and most of the aldehyde and hydrocarbon fumes in engine exhaust. It can be used on both unleaded and leaded fuel.

Efficiency of the purifier holds up for at least 600 hr. of operation, equivalent to about five months' fork lift truck use in many plant operations. A pyrometer indicator on the instrument panel tells the operator when catalyst efficiency has dropped. Then the catalyst pellets can be removed quickly and replaced with fresh ones.—**Oxy-Catalyst, Inc., Wayne, Pa. 262E**

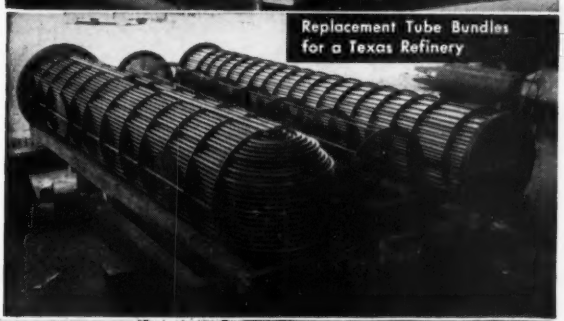
**For More Information . . .**

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

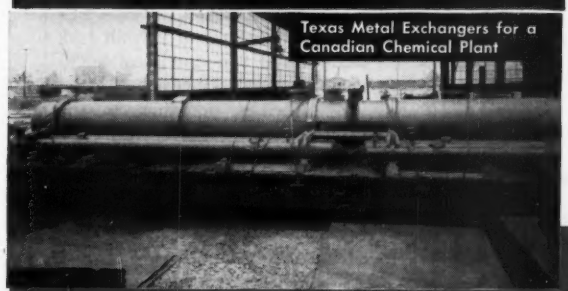
# A Superior Service for HEAT EXCHANGERS



One of two identical Reboilers built for an Eastern Chemical Plant



Replacement Tube Bundles for a Texas Refinery



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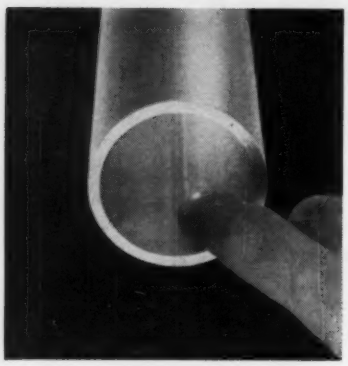


## Welded Tubing

**Is free from bead on inside.**

By a new patented process, welded stainless steel and high alloy tubing and pipe are made without any bead along the weld inside the tube. As a result corrosion resistance is improved and the surface is better for rolling tubes into tube sheets. Many high or super alloys that previously had to be welded into tube sheets now can be rolled in.

Many alloys that previously could not be fabricated as welded tubing now can be furnished because of the Trentweld method. Among the high-quality, full-finished tubing now available are the various Hastelloy grades, zirconium, Zircoloy, titanium and 19-9-DL.

Simple as it sounds, the weld bead is eliminated by welding the formed tubing from the underside. The leveling effect of gravity eliminates the bead.—**Trent Tube Co., East Troy, Wis.** **264A**

## High Pressure Pumps

**For controlled capacity, use 30% less power.**

A new series of high pressure, reciprocating plunger pumps for pressures up to 50,000 psi. require 30% less power than normally required. Lower horsepower requirement for these controlled-capacity pumps means lower first cost for the pump and for the motor and speed reducer.

Pumps can handle liquids or slurries that are free-flowing, viscous or tarry; also corrosive acids, alkalis, salts, oxidizing and reducing agents. They can accurately meter output from 2 cc. per hr. to a maximum of 15,000 gph.; are available in simple, duplex, triplex and quadruplex types adaptable to manual or automatic control.—**Philadelphia Pump & Machinery Co., 1513 Race St., Philadelphia, Pa.** **264B**

## Pump for Hot Liquids

**Canned model with external heat exchanger.**

Newest addition to the Chempump line of canned-motor pumps can handle Dowtherm, Arochlor, hot fats, hot oils and similar liquids at temperatures as high as 1,000 F. Operation at these elevated temperatures is possible through a special high-temperature design and an external heat exchanger.

In common with other Chempump models the high-temperature pump operates with system fluid circulating through the canned motor. However, before the system fluid enters the motor it is cooled in an external heat exchanger.

Between the motor and pump is a "necked down" area that acts both as a thermal barrier and as a restriction against passage of the hot system fluid. There is very little intermixing of hot fluid in the pump chamber and the relatively cool fluid in the rotor chamber of the motor.

Model CHS pumps are available in 5 and 7.5 hp. sizes. Also available with high temperature design is model CFT in ¾ and 1½ hp. sizes.—**Chempump Corp., Station I, 1300 East Mermaid Lane, Philadelphia 18, Pa.** **264C**

## Armored Pipe

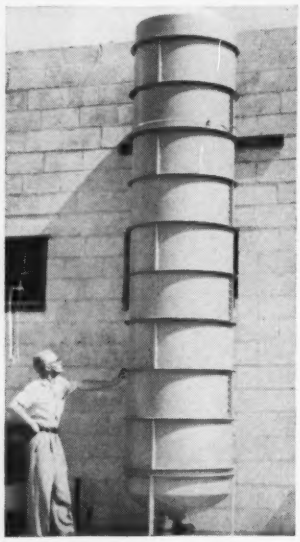
**Constructed of impervious graphite.**

Pipe and fittings of Impervite impervious graphite are now available with a fibrous glass armor. Use is recommended wherever increased operating safety is desired for personnel and equipment.

Armor provides a substantial safety factor against breakage from exterior physical shock. Also, it eliminates excessive damage that results from most high-pressure explosions.

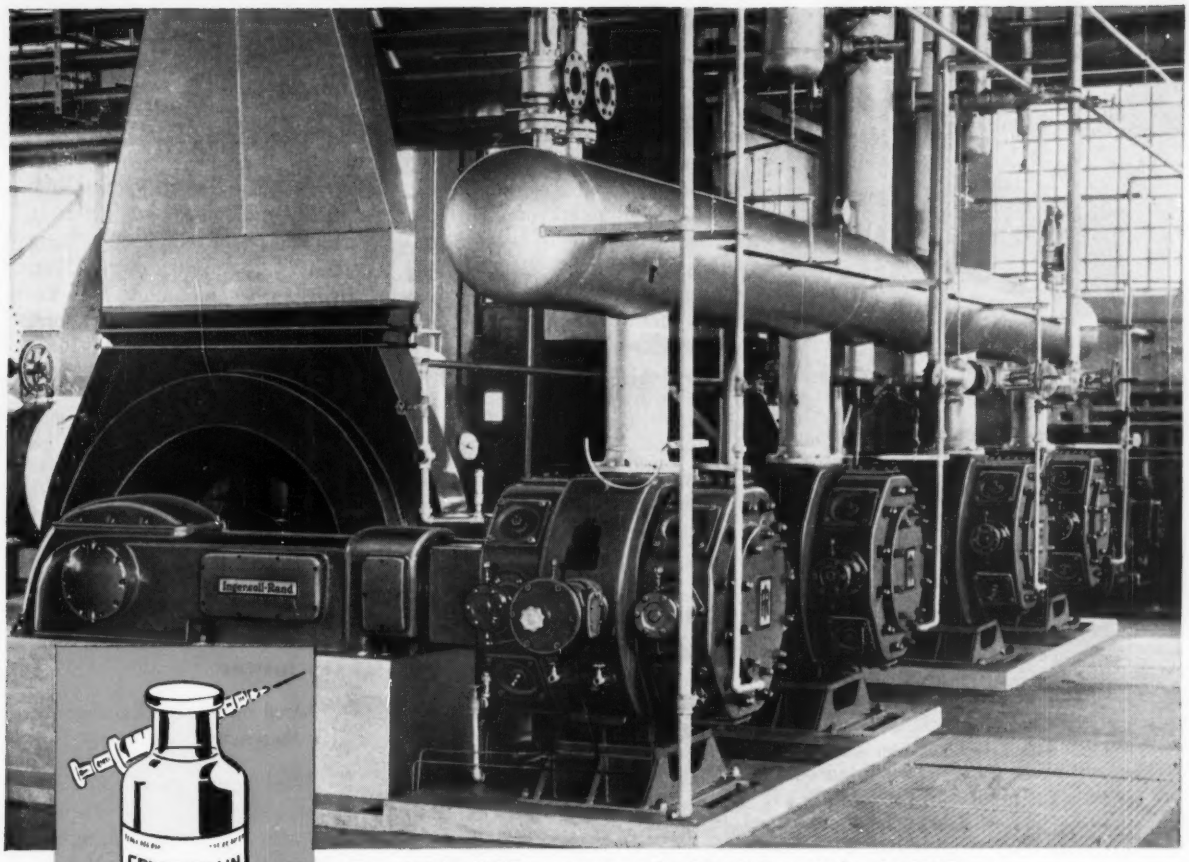
Where abnormal usage causes a fracture, the armor holds the pipe together so that corrosive flow remains under control until corrective action can be taken.

All armored Impervite pipe fittings, valves and other equipment have the same dimensions as non-armored material. The thickness of the armor varies between ⅛ and ⅜ in. according to the size of the equipment.—**Falls Industries, Inc., Aurora Rd., Solon, Ohio.** **264D**



## Modular Tank Elements

**Just stock a supply of Polybilt tank sections and you can assemble, to meet your need, a choice of 50 styles and capacities, according to the manufacturer. Tanks of this polyester resin, glass fiber laminate cost 76¢ per gal., a real saving over stainless and Monel at $1.25 and $1.35 respectively. Weight reduction is even more dramatic—on the order of 75%. Joints are sealed with neoprene gaskets. For strong alkalis or oxidizing acids, sections are coated with epoxy or phenol-furfural coatings. Top temperature for continuous service is 200 F.—Copolymer Corp., 3716 West Jefferson Blvd., Los Angeles 16, Calif.** **264E**




Two 400 hp PRE compressors furnish oil-free air for the E. R. Squibb & Co. penicillin plant in Santa Amaro, Sao Paulo, Brazil

# Penicillin manufacture demands clean, oil-free air

Compressed air is the best medium for the agitation and oxidation of antibiotic fermenters in the manufacture of penicillin. However, conventional compressors allow some of the lubricating oil from the compressor cylinder to carry over in the air which would contaminate the finished drug and perhaps kill the precious organisms that are vital to the process.

The solution to this problem was simple enough ... Ingersoll-Rand NL non-lubricated compressor cylinders were specified. These cylinders use special carbon wearing rings and piston rings that require no external lubrication. And the only special maintenance required is a yearly check of piston clearance to determine if new wearing rings are required.

This famous NL construction, an Ingersoll-Rand first, is the answer to many compression problems where oil may not be used, whether it be in drug, food, power or chemical plants. NL cylinders can be furnished on compressors from ½ to 1000 horsepower. For further information contact your local Ingersoll-Rand representative or write.

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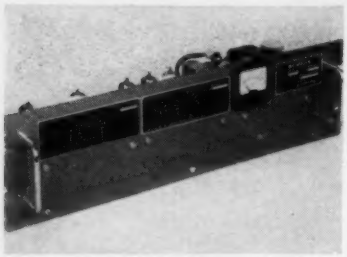


## Controller

**Can be mounted on standard rack.**

A new all-electronic controller can be mounted on a standard radio relay rack. It is available with prefabricated cable for connection to the other components in the manufacturer's electronic process control system.

Rack-mounting simplifies mounting problems and allows easy accessibility for adjusting controls. Control units can be mounted one above the other to form a continuous panel surface with all control adjustments at the front.

The prefabricated cable harness for connecting units of the system reduces cost of panel fabrication. Too, it eliminates cost of making individual wiring and piping connections.—**Industrial Controls Div., Manning, Maxwell & Moore, Inc., Stratford, Conn. 266A**

## Control

**Fast, flexible electrical control with pneumatic valve operation.**

For processes that normally require a pneumatic control system the Electro-Pneumatic control offers all the advantages of pneumatic valve operation in combination with a flexible, rapid electrical control system.

Inherent advantages of such a system are rapid measurement, transmission and control through electrical response; simplicity, low cost and safety of a pneumatic operator; and shorter air lines and easier installation.

Series 60 control system is built around an electric control unit with proportional, automatic reset and rate actions; and its associated electro-pneumatic converter.

The three control actions regulate process input according to size, speed and duration of change in variable. Changes in process variable are measured by the electronic recorder or indicator and relayed to the control unit. Current output of the control unit is balanced in the electro-pneumatic converter against the air output of the converter which operates a pneumatic valve on the process line.—**Leeds & Northrup, 4934 Stenton Ave., Philadelphia 44, Pa. 266B**

## Temperature Control

**Holds temperature on set point over wide range.**

Process temperatures up to 2,500 F. can be controlled within ±1% of scale with the model PB indicator-controller. Operating on a current of less than 1 microampere this instrument has a long life expectancy.

Pyrometer unit in the instrument indicates the temperature under control up to the control point. An electronic control unit opens and closes the load relay regulating fuel supply to the controlled process.

Contacts in the control are said to have exceptionally long life. The unmatched tubes can be replaced easily and may be obtained from any radio or electronics supply house.

Instrument available in ranges of 0 to 600, 1,000, 1,500, 2,000, and 2,500 F.—**Automation Instrument Corp., 1516 Summer St., Philadelphia, Pa. 266C**

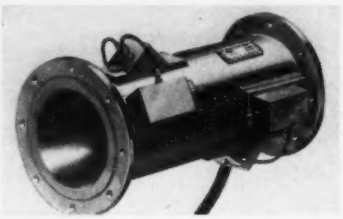
## Level Indicator

**For solvents, oils, acids and chemicals.**

Control or indication of liquid level is the function of the F-8685 hermetically sealed float-level indicator. It has no exposed metal parts and may be used with a wide variety of liquids.

Float rides on a nylon stem that encloses a single-pole, single-throw switch. Permanent magnets imbedded in the free float actuate the switch within the stem.

Float indicator is 3.31 in. long and 1.22 in. in dia. Switch has 100,000 cycle minimum life.—**Revere Corp. of America, Wallingford, Conn. 266D**



## Flowmeter

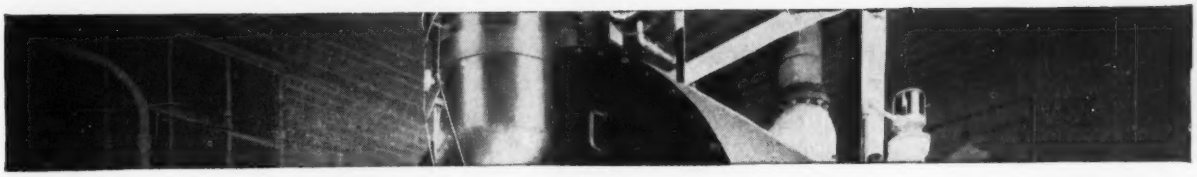
**Based on ultrasonics, measures either mass or volume.**

Tabbed as the world's first successful industrial ultrasonic flowmeter a new instrument accurately measures either mass or volumetric flow. Accuracy is not affected by pressure, viscosity, gas bubbles, solids in suspension, electrical conductivity or position of installation Pressure drop is said to be virtually zero.

Flowmeter is built into a short pipe section. Two transducers are positioned along the pipe in diagonal position from each other. Each transmits and receives controlled pulses of ultrasonic energy across the pipe section, sensing the difference in the number of pulses received.

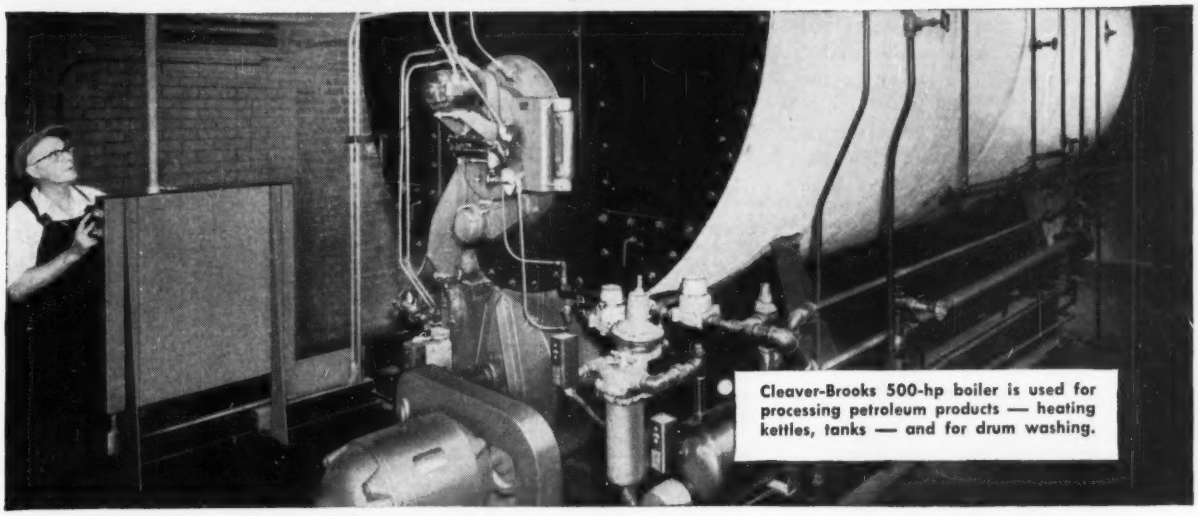
An increasing flow rate increases the number of downstream pulses and decreases the number of upstream pulses. The repetition rate of these pulses cancels out sonic velocity leaving only the difference in repetition rate. This is proportional to flow velocity.

By adding a third transducer to give a density measurement the instrument is converted into a mass flowmeter. The mass transferred through the line may be totalized by integrating the gravimetric rate signal, using a built-in analog computer.—**Fischer & Porter Co., Hatboro 35, Pa. 266E**



# "We heard Cleaver-Brooks Boilers were OK"

**. . . and what an understatement that proved to be for a Milwaukee petroleum marketer***



Cleaver-Brooks 500-hp boiler is used for processing petroleum products — heating kettles, tanks — and for drum washing.

## *Look at the record:*

# 350 gallons of fuel oil saved per day!

**On an annual basis — that's more than 90,000 gallons of oil saved.**

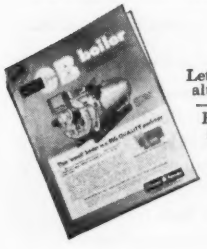
*Complete shutdown flexibility with the assurance of fast steaming from a cold start is the key to these remarkable savings* for a petroleum processor and marketer in Milwaukee, Wisconsin. Now, a Cleaver-Brooks 500-hp boiler operates 10 hours a day, 5 days a week, where formerly two 150-hp units operated continuously 24 hours a day, 7 days a week. Fewer boiler working hours also saves up to $11,000 yearly in maintenance.

By replacing outmoded equipment, this petroleum processor also enjoys the benefits of guaranteed 80% operating efficiency, four-pass design, forced draft, 5 sq. ft. of heating surface per boiler-hp and fully-automatic firing. Cleaver-Brooks Company, Dept. P, 345 E. Keefe Ave., Milwaukee 12, Wisconsin — Cable Address: CLEBRO — Milwaukee — all codes.

**Name supplied upon request.*

**Look at these "before-and-after" facts**

| | NEW (1) 500-hp Cleaver-Brooks boiler | OLD (2) 150-hp obsolete boilers |
|---|---|---|
| FUEL CONSUMPTION | 450 gal. per day (10-hr. day)<br>46 gal. per hour (operating hour) | 800 gal. per day (24-hr. day)<br>60 gal. per hour (operating hour) |
| SCHEDULED STEAM SERVICE | Automatic firing from 6:30 a.m. to 4:30 p.m. Fast steaming from a cold start. | Continuous 24-hr. operation. Couldn't shut down. Wasted heat. No benefit from extra hours of operation. |
| OVERALL EFFICIENCY | Average 125 lb. of steam per gal. of oil. | Average 96 lb. of steam per gal. of oil. |
| OVERALL MAINTENANCE | Cleaned every 6 months. Single maintenance foreman. | Cleaned every 6 weeks. Required extra fireman for weekends. |




Let us help you beat the penalties of boiler obsolescence — with a modern Cleaver-Brooks installation. Sizes from 15 to 600 hp, 15 to 250 psi — steam or hot water, for heating or processing. Write for catalog.

**Cleaver Brooks** 25th YEAR

TWENTY-FIVE YEARS OF LEADERSHIP BY THE ORIGINATORS OF THE SELF-CONTAINED BOILER

## Die Lubricator

**Keeps pipe dies working well.**

The new portable Ridgoilr solves the problem of flooding the die with cutting oil while threading pipe with hand die stocks either manually or with power. More than 95% of the oil is saved and reused repeatedly.

Oiler has an oil reservoir with a removable chip pan. A screened hose connects with a hand-operated oil pump gun. Placed under the work, the device catches oil, chips and cut-offs. Clean oil can be circulated continuously on the die. **–The Ridge Tool Co., Elyria, Ohio.** 268A

## Gamma Ray Projector

**For weld inspection, cuts cost.**

A portable gamma-ray projector that boasts decided advantages over conventional x-ray equipment is now available for radiography work. M. W. Kellogg has used prototypes of the new projector for some time to check welds before putting process vessels into operation.

Projector is extremely safe to operate, costs only a fraction as much as comparable x-ray equipment, is extremely portable, needs no electricity, no control board, no maintenance beyond replenishment of the radio-isotope, and can take a picture over 360 deg.

The Kel-Ray projector is shielded with lead. A lensless shutter can be opened and closed from a safe location. The gamma ray source is a small metal capsule inside the housing.

When welding of a vessel is finished, segments of x-ray film are placed around the weld on the outside of the tank. Then the Kel-Ray projector is positioned inside the vessel and opened for the proper exposure time. Film can be developed on location to detect flaws and take corrective action before the welding crews have been dismissed.**–Metal & Thermit, 100 East 42nd St., New York 17, N. Y.** 268B

## Expander Control

**Assures uniform expansion of tubes into sheets.**

Designed for use with any standard tapping motor, a new electric control assures the same expansion of each tube after metal-to-metal contact regardless of small variations in size of tube and tube sheets.

Included in the control is a unique and exclusive voltage balancer. With this device there is no need for a voltage regulator. The operator just balances the voltage and sets the torque control. No further adjustment is needed during the tube rolling operation other than an occasional check on the voltage balance.

Any one of three standard tapping motors with built-in reversing gear and quick-change chucks can be furnished with the electric control.**–Lagonda Div., Elliott Co., Springfield, Ohio.** 268C

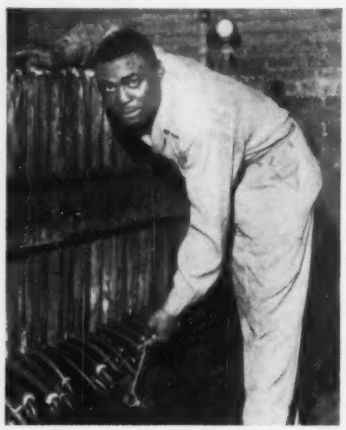
## Valve Covers

**Give warning of leaks.**

The new Spray-Stop valve and flange covers protect workers and equipment and also give warning of a leak.

When struck by leaking chemicals the Spray-Stop undergoes a vivid color change. Anyone in the area is immediately aware of the leak because of the telltale color. By aiding the discovery of leaks while they are still small these covers prevent large-scale repairs and excessive downtime.

As an added safeguard the unique color-changing agent is not affected by fumes although it changes immediately when contacted by liquid.**–Neirad Industries, Inc., P. O. Box 865, Darien, Conn.** 268D



## Resistant Clothes

**Have chalked up impressive operating record.**

This filter press operator is wearing an acid-resistant Dynel uniform issued to him in June 1954. It is one of 140 uniforms of this type issued by Stauffer Chemical at its Brooklyn plant. After 15 months in service, it is reported, not one of these uniforms has been replaced. Average life of old-style garments was 2 months under exposure to tartaric and sulfuric acids.

For the first time these uniforms are being sold at a price approaching the cost of a comparable cotton uniform. The spun-dyed fabric also is reported to show unusual fastness and uniformity of color.**–Wynko Mfg. Co., 175 Main St., White Plains, N. Y.** 268E

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

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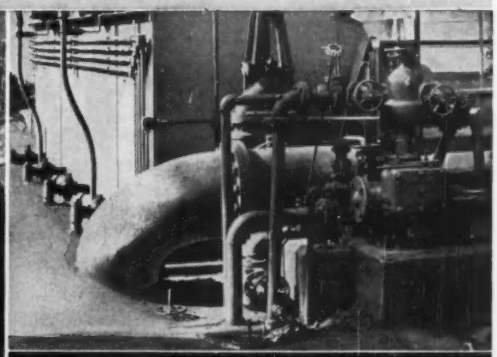
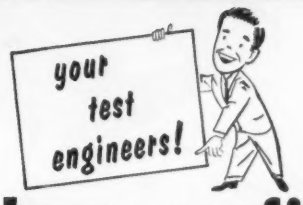
**$3,000,000 Recovered Annually** — A Denver Reclamation System helps recover $3,000,000 in silver from waste photographic film and paper in the world's largest photo-chemical plant. Similar Denver Reclamation Systems in other industries recover platinum from refractory slag, aluminum, magnesium, zinc and manganese from slag, low ash coal from stream bottoms, and de-ink waste paper for re-use.



**$64,000 Net Profit in 4 Months** — A large steel corporation recovers naphthalene from the cooling water in their coke plant with a Denver Reclamation System. Recovery of the by-product naphthalene is 100%. Sale of the by-product naphthalene produced a net profit of $64,000 in the first four months' operation.




# DECO testing lab shows how profits can be recovered from industrial waste

If you have a valuable product in your industrial waste, find out how Deco can help you recover it at a profit. These case histories are a few examples of how company engineers have worked with the Denver Equipment Company to perfect reclamation systems. These systems have made profits for their owners.

Your engineers are welcomed in our laboratories. We have complete batch test and pilot plant facilities.

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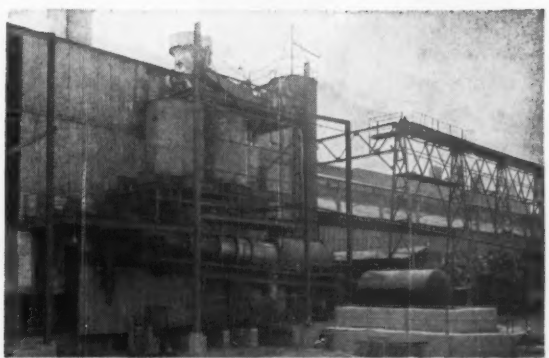

**$43,000 Saved Each Year** — A Denver Reclamation System is reclaiming formerly discarded molding sand, and saving a large foundry this amount each year. Deco test investigations often can take an operator's or plant engineer's idea and develop a system producing a new profit — giving his plant a new competitive advantage in a profit-tight industry.

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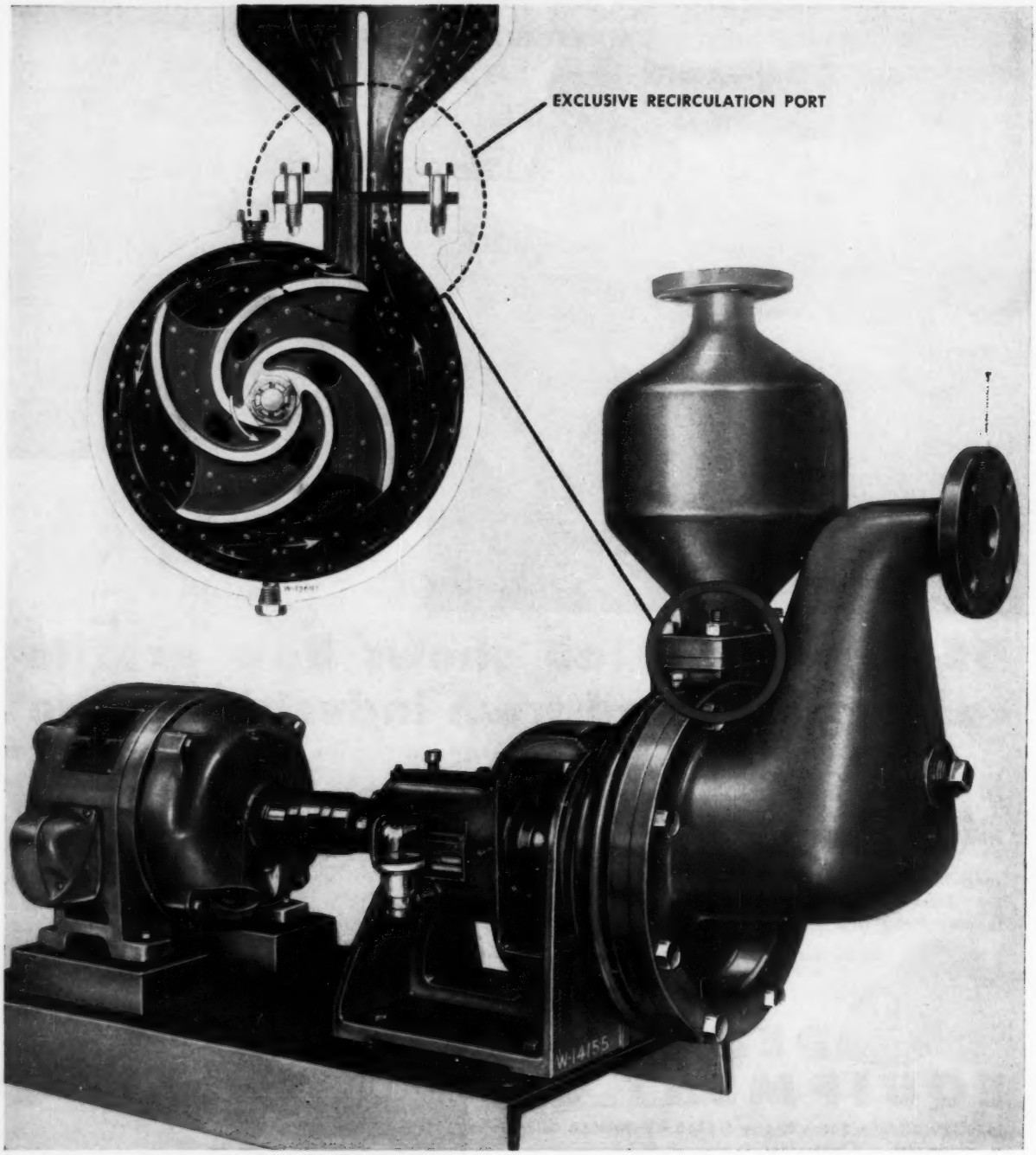
# NEW! Self-priming Worthite*




**NEW WORTHINGTON SELF-PRIMING PUMP** with motor and base. Three standard sizes fit this versatile pump to a variety of capacity and head requirements.

As shown in cutaway, impeller mixes liquid trapped in suction chamber with vapor or air from suction and forces mixture into recirculation chamber. Vapor leaves by discharge pipe, while vapor-free liquid falls back through recirculation port *(red)* for remixture with vapor. Process continues until pump is primed. Easy replacement of recirculation port permits use of variety of impeller sizes and maintenance of critical clearance between impeller and port.

* **Worthington's *super-stainless* corrosion resisting alloy steel.**

# centrifugal chemical pump

## Features wider coverage in capacity and head than any similar pump in the chemical industry

Three pump sizes, plus exclusive Worthington removable RECIRCULATION PORT, plus a variety of different impeller diameters for each pump, make this new pump the most versatile self-priming corrosion resistant pump available.

It's the Worthington type CNGK. Part of the Worthington SESC line, this new pump is recommended for chemical sump pumping, tank-car unloading, or any application where both liquid and vapor handling capacity is required.

Key to the CNGK's flexibility *(see photo at left)* is the exclusive new Worthington removable recirculation port. Here's what the removable recirculation port gives you:

**1. Wider coverage without the use of belt drive.** In each pump size, impeller diameter can be cut down with very little change in priming time. Various combinations of impeller diameters, and recirculation port lengths are available for each pump. This means that the close clearance required between impeller and recirculation port can be maintained regardless of impeller diameter.

**2. Renewable clearance at tongue.** Removable recirculation port allows replacement of this part in those services where severe wear may be encountered. This feature enables the pump user to renew a critical clearance with a small repair part.

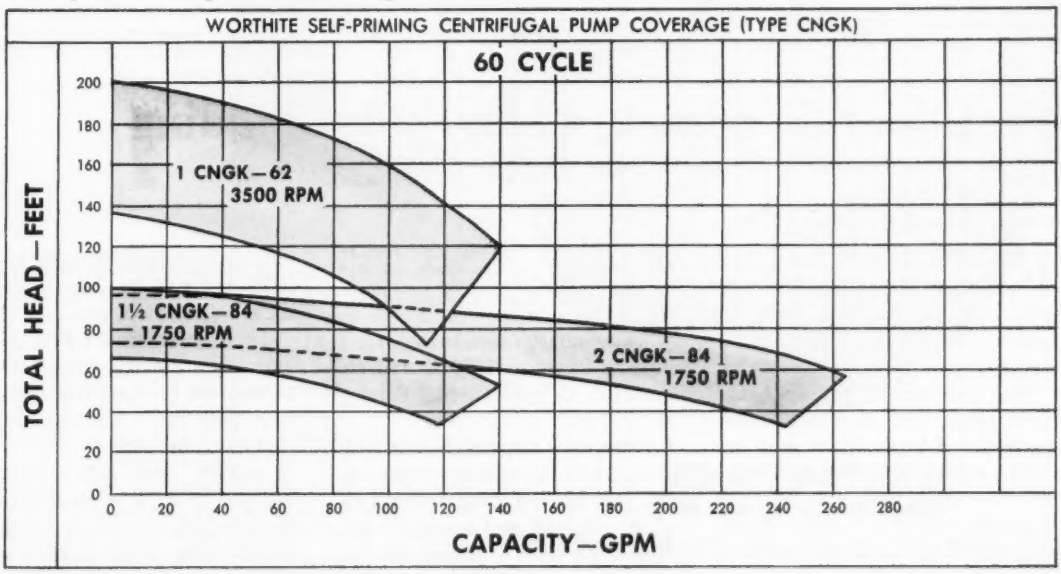
**3. Smaller, lighter pump with faster prime.** The recirculation port is designed for maximum recirculation velocity. This cuts down the volume of liquid required to transfer a given amount of air or vapor from the suction to the discharge pipe and allows smaller volume for suction and discharge chambers than in other designs.

**4. Versatility** is further carried out since these pumps are designed for both packed stuffing box or mechanical seal operation. Worthington's type EA mechanical seal, proven over many years of operation in the Chemical Industry, is available on the type CNGK pumps. The pump and mechanical seal are an integrated design, and all parts of the mechanical seal are as corrosion-resistant as the pump itself.

Remember—the CNGK is part of the standard SESC pump line. Minimum use of special parts means lower initial costs and easier, faster servicing.

For complete data on this latest Worthington standard chemical pump, write today for bulletin W-350-B-13. Worthington Corporation, Section PC.5.39, Harrison, New Jersey.

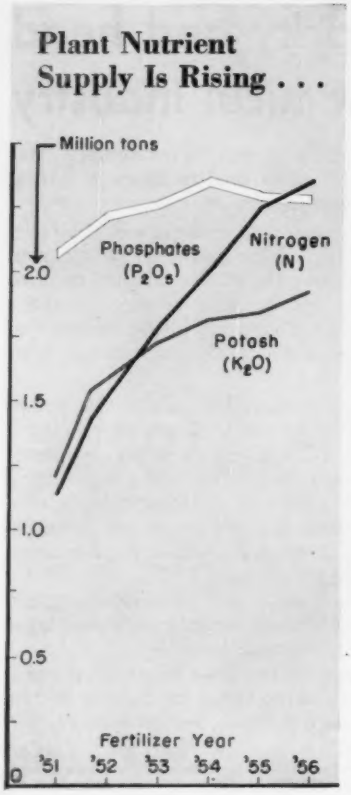
PC.5.39




**WIDER HYDRAULIC COVERAGE** than for any other self-priming centrifugal chemical pump is provided by the new CNGK. Chart shows coverage for 60-cycle motor speeds (50-cycle ratings on request).

**Be sure to see this new pump at Booth No. 848, Chemical Show, Philadelphia, December 5-9, 1955**

**WORTHINGTON**




**Because of . . .**

- **Steadily increasing demand for all fertilizer materials**
- **More ammonia for direct application and mixed solutions**
- **More high-analysis, granular fertilizers**
- **More fertilizer-pesticide mixtures**
- **Better processes and equipment**

**But There Are Dangers . . .**

- **Surplus capacity, particularly for nitrogen**
- **Declining farm income**
- **Lower acreage allotments**
- **Price cutting in ammonia**

# Fertilizer Forecast: Clear but Clouding

**Robert B. Norden, Assistant Editor**

FOR THE fertilizer industry there are some disturbing signs—surplus capacity, declining farm incomes, lower acreage allotments for many crops.

But the over-all picture is far from black. Just recently the Department of Agriculture came out with a report predicting that in the 1955-56 season (July 1 to June 30) required supply of fertilizer nutrients will be 2.5% above the peak '54-'55 season. This is based on USDA estimates of production (not capacity), trends in consumption and foreign trade, and should be fairly close to actual consumption this season.

A breakdown of the data shows (in million tons):

| | 1955-56 | 1954-55 |
|---|---|---|
| Nitrogen (N) | 2.350 | 2.250 |
| Phosphates ($P_2O_5$) | 2.300 | 2.312 |
| Potash ($K_2O$) | 1.939 | 1.865 |

Some industry trends took more definite forms in 1954-55 and are expected to continue to develop in 1955-56.

► **Nitrogen Expansion**—For instance, take the nitrogen expansion. On July 1, 1954, total nitrogen capacity (natural and synthetic) was equivalent to 2.6 million tons in this country. By last July we had a capacity of 3.29 million tons of nitrogen and next July it's expected to be 3.9 million.* For synthetic alone, capacity was 2.89 million tons of contained nitrogen in July 1955 and will be 3.6 million by the middle of next year.

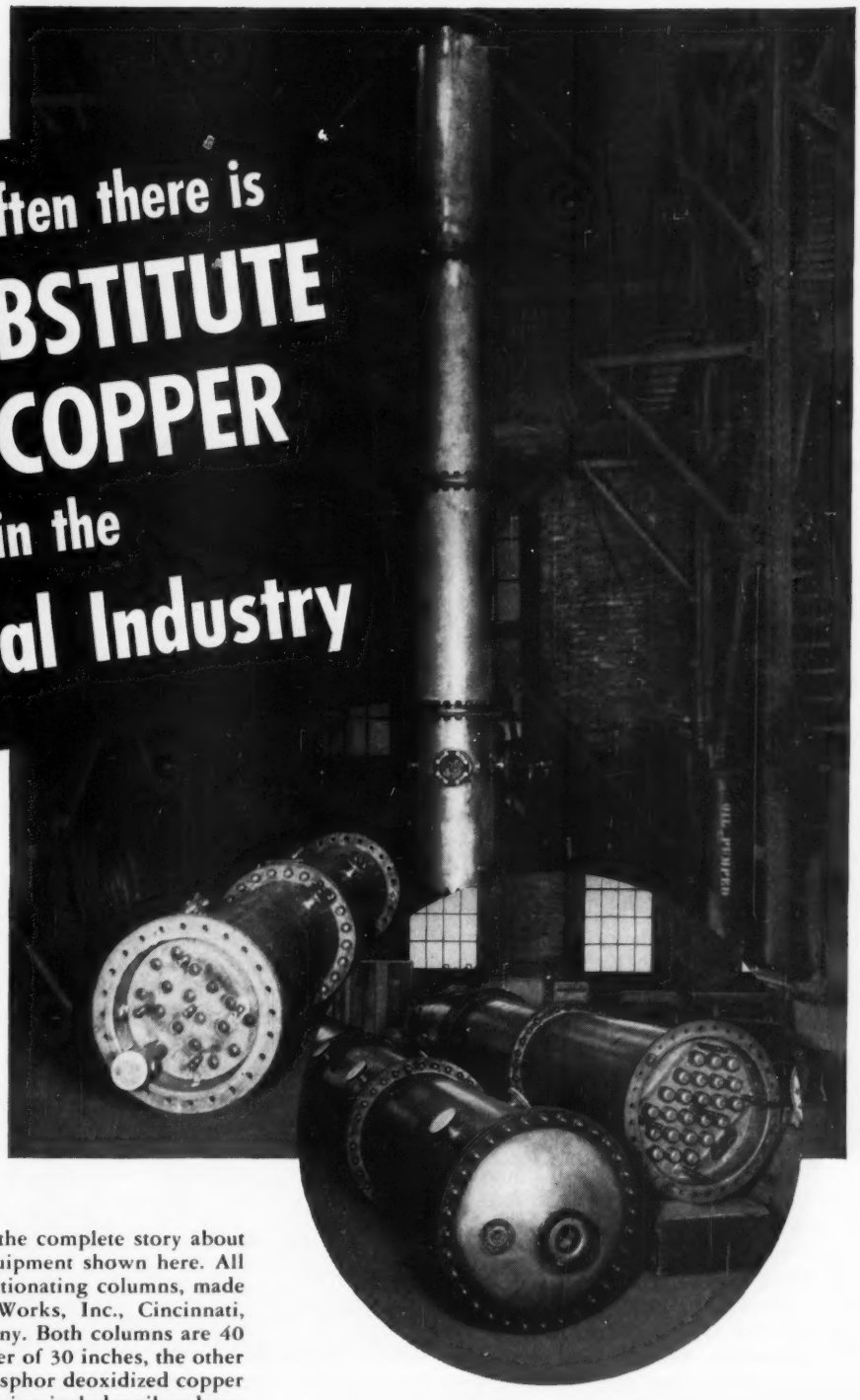
There is no doubt that this is more than enough, both for agriculture and for industrial and military purposes. Agricultural consumption in 1954-55 was about 2 million tons and production dropped to 82% of total capacity. Back in 1952 the nitrogen industry was barreling along at 95% of capacity.

► **Will It Last**—Most forecasters are agreed that we have surplus capacity. But there is anything but agreement as to how long this surplus will last.

USDA estimates that agriculture will require about 3 million tons of

* Canadian capacity—much of which is exported to the U. S.—will go up from 306,000 tons of nitrogen to 394,000 in 1954-56.

# So very often there is NO SUBSTITUTE FOR COPPER in the Chemical Industry



Fractionating columns made by Ansonia Copper & Iron Works, Cincinnati, Ohio, for a prominent chemical company. Ansonia was established in 1896, and has always been a customer of Revere—good companies like to do business with each other!

● We wish we could tell you the complete story about the two pieces of chemical equipment shown here. All we can say is that they are fractionating columns, made by Ansonia Copper & Iron Works, Inc., Cincinnati, Ohio, for a well-known company. Both columns are 40 feet high, and one has a diameter of 30 inches, the other 24 inches. Revere supplied phosphor deoxidized copper plates, and copper pipe. Fabricating includes silver brazing with compressed natural gas.

You will find a lot of copper, various types of Revere Copper, in chemical plants. The metal has many advantages, including the highest heat transfer of any commercial metal, complete lack of reaction to many chemical fluids and gases, long life, the high electrical conductivity that is sometimes important, and surprisingly easy fabrication by stamping, bending, soldering, welding, brazing. If you are fabricating or ordering chemical equipment, look into Revere Copper. We will gladly collaborate with you on specification and fabrication matters. Just get in touch with the nearest Revere Sales Office.

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nitrogen by 1959-60. Industry will probably take slightly over 1 million tons. One group of market researchers believes that demand won't catch up with capacity until 1959.

But another group believes that requirements will increase more rapidly in agriculture (more than the usual 10%/yr.) and that there will be no large overcapacity in two years. They stress the point, though, that a selling job has to be done on the farmer. The amount of fertilizer used per acre in the U. S. is low compared with western Europe and Japan. These countries are extreme examples, but we will have to go in that direction. Most of our tillable soil is being cultivated now and our population, now 166 million, is expected to be at least 200 million in 1970.

No matter which group is right, one portent of the future is the recent drop in ammonia price—down from $145/ton to $120/ton this year in Missouri and Arkansas, $10-20/ton decrease in other parts of the country.

▶**Direct Application Grows**—Another trend which is showing up sharply and which should have an important influence on consumption is ammonia used for direct application to the soil. About 414,300 tons of ammonia (N content) was delivered for this use in the 1954-55 season. Requirement in 1955-56 will be about 460,000 tons—a healthy 11% increase. In fact, the 1955-56 tonnage represents 19% of the total nitrogen fertilizer supply.

During the Feb.-May 1955 application season, demand for direct application nitrogen was greater than supply and this situation is expected to repeat next spring. This is because farmers now buy fertilizers as they need them, thus create peak-season shortages and off-season surplus. In 1942-48 farmers bought fertilizer well in advance of the spring season because fertilizer was almost always scarce.

Most major nitrogen producers are combatting this new situation by installing equipment to make other forms of fertilizers which can be used out of "season" or which increase storage capacity. Federal and state governments and the National Plant Institute have an intensive campaign on to increase the practice of fall fertilization.

▶**Split Field**—Nitrogen solutions took only a small share of the direct application market in 1954-55—about 35,000 tons of nitrogen, or 8%. But it should be up to 50,000 tons in 1955-56. Government figures show only solutions containing ammonia-ammonium nitrate, ammonium nitrate and ammonia-urea solutions. But the entire solutions field bears watching, for many experts think that solutions have big potential—particularly those corresponding to standard mixed fertilizers.

Liquids are somewhat cheaper than solid mixtures and have no caking or segregation problems. But there are shortcomings: High freight costs (because of high water content) limit distribution; and cold weather tends to cause salting out.

On the West Coast, however, liquid mixes are catching on. In 1955, ammonia solutions, among individual types, were first in consumption in California, ahead of dry, mixed fertilizers. Brea Chemicals, in California, has gone into liquids with three plants having a total capacity of 50,000 tons/yr. of ammonium phosphate solutions.

Of course, liquids have a much larger outlet for ammoniation of superphosphate mixtures. The supply in 1954-55 was about 423,000 tons of nitrogen for ammoniation and should be 430,000 tons in 1955-56. Here the solutions act as the main nitrogen carrier.

▶**Other Nitrogen Carriers**—Solid ammonium nitrate held its own in 1954-55—408,000 tons of nitrogen produced, 11,000 tons exported and 133,000 tons imported. These figures in the current season are expected to be 420,000 tons, 15,000 tons and 120,000 tons. Ammonium nitrate holds a dominant position as a fertilizer for direct application. No spectacular developments are foreseen that will change this situation in the near future.

Ammonium sulfate is another fertilizer chemical—used mostly in mixtures—that probably has hit a peak. Production will be up in 1955-56 to 405,000 tons of nitrogen, compared with 357,000 tons in 1954-55. Exports will be stepped up from 90,000 tons to 110,000. But there is a discouraging sign: Producers—particularly synthetic producers—will have to buck the growing practice of making the sulfate in situ during the production of mixed fertilizers.

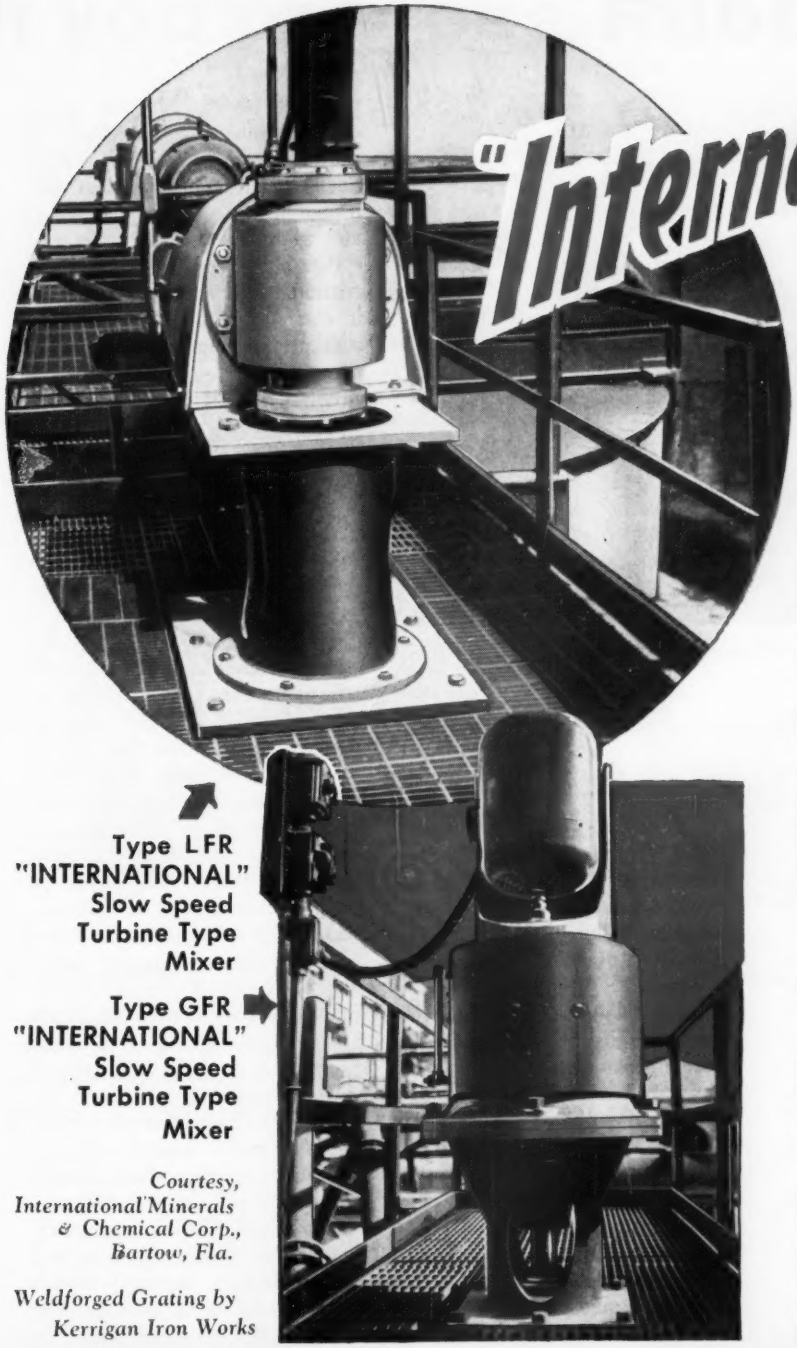
But while ammonium nitrate and ammonium sulfate may have reached plateaus, this is definitely not true of urea. Four companies made urea this year—Grace, Deere,

## INDEXES
(1935 = 100)

| | | | |
|---|---|---|---|
| **Business Activity** | Sept. | 1955 | 311.8 |
| **Chemical Consumption** | July | 1955 | 254.6 |
| | June | 1955 | 288.7 |
| | July | 1954 | 240.0 |

**Chemicals by Industry**

| | Aug. (Prelim.) | July (Rev.) | | Aug. (Prelim.) | July (Rev.) |
|---|---|---|---|---|---|
| Fertilizer | 45.62 | 31.29 | Textiles | 10.84 | 8.74 |
| Pulp & paper | 36.32 | 32.36 | Coal products | 12.02 | 11.78 |
| Petroleum refining | 30.56 | 30.56 | Leather | 4.25 | 4.25 |
| Iron & steel | 17.60 | 16.69 | Explosives | 10.70 | 8.60 |
| Rayon | 29.92 | 29.12 | Rubber | 6.94 | 6.24 |
| Glass | 28.79 | 26.08 | Plastics | 19.50 | 18.89 |
| Paint & varnish | 33.07 | 29.95 | Total | 286.13 | 254.55 |



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**Type GFR "INTERNATIONAL" Slow Speed Turbine Type Mixer**

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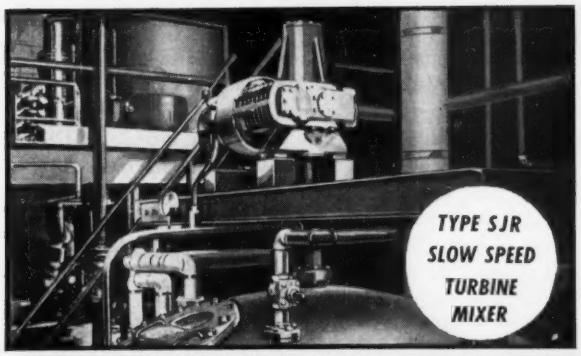
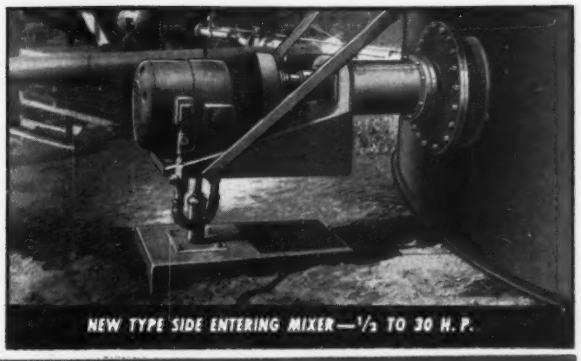
| Side Entering Mixers and Agitators | 72-A |
| Dry Blenders and Ribbon Mixers | 78 |
| Grinding and Mulling Fans | 5-A |
| Portable Mixers | 74-A |
| Mixing and Extruding Machinery | 62-A |
| Ball and Pebble Mills | 100 |
| Continuous Mixers | A |
| Stack Fans and Duct Boosters | 109-A |
| Laboratory and Pilot Plant Equipment | 77-A |



SPRAYING of nitrogen solutions (excluding $NH_3$) should rise 40% this season.

Du Pont and Allied. Production now is around 100,000 tons/yr. (N content), but should jump to nearly 300,000 tons by 1956-57, with most of the increase taken up by agriculture. Urea has a high nitrogen content (46%) and now the delivered cost per unit of nitrogen is about the same as for ammonium nitrate. With the price dropping, urea should become very popular with farmers.

▶ **What About Other Nutrients?**—All the activity in nitrogen doesn't mean that potash and phosphates production is slackening.

In 1954-55 the emphasis was on higher concentration products, particularly in mixed fertilizers. And this shows up in the activity of concentrated superphosphate. Normal super contains 15-21% $P_2O_5$, while triple super contains 40-50% $P_2O_5$. On a cost-of-production basis, normal super can't be beat. But the advantage of concentrated forms shows up when handling, bagging and shipping costs are taken into account.

Right now there are 16 triple super plants in this country.* Capacity has leaped 187% since Jan. 1952, with a 4% increase in normal super capacity during the same period.

U. S. production of triple super was 619,000 tons ($P_2O_5$) in 1954-55. Anticipated output for 1955-56 is 650,000 tons. In the same period, normal super will slip from 1.492 million tons of $P_2O_5$ to 1.452 million tons.

This availability of concentrated phosphates has helped the trend toward high-analysis mixtures containing up to 45% plant nutrients. A typical high-analysis mixture is 10-10-10. This means 10% (or 10 units) each of N, $P_2O_5$ and $K_2O$. Mixtures are calculated on a net ton basis, so there would be 200 lb. of each nutrient.

It's impossible to make this with normal superphosphate, but only 500 lb. of triple would be needed. Where freight costs are a big factor, concentrated super is rapidly taking over. But the less concentrated form should hold its own in the South where most of the normal superphosphate plants are located, close to their markets.

During the coming year some 250,000 tons of $P_2O_5$ capacity will come on stream, most of it in the form of ammonium phosphate. A lot of interest was stirred up early this year when Missouri Farmers started its 200-ton/day fertilizer plant at Joplin, Mo. It makes diammonium phosphate and is turning out an 18-48-0 grade. Also, Shell Chemical, at Pittsburg, Calif., is pilot-planting a DAP process that uses white acid and ammonia.

▶ **Potash Is Vital**—Interest in concentrated fertilizers is also reflected in the potash picture. The most concentrated form—potassium chloride—leads the way. Supply of the chloride was 1.705 million tons ($K_2O$) in 1954-55 and should be 1.750 million tons in 1955-56. Actually, consumption lagged behind capacity last year. As of July 1955 we had plant capacity for 2.1 million tons of $K_2O$ as potassium chloride and it will be 2.5 million tons in about two years.

There's a lot of interest in the new Sasketchewan deposits. Some call them the largest reserve in North America, but the salts are harder to recover than those in the Carlsbad, N. M., field. Most American producers have acquired rights to mine potash in Sasketchewan and it looks very much like these deposits will shift the balance of world market control to this continent.

While chloride supplies about 90% of the total $K_2O$ market, there were lively doings in potassium sulfate in 1955. Three U. S. firms made sulfate and one—International Minerals—upped capacity by 40,000 tons (of sulfate) to reach a level of 150,000 tons. Traditionally, sulfate is used for crops where chloride toxicity is a problem (like tobacco). Potassium chloride is a natural salt, however, and will continue to be a basic fertilizer material—though there should be a growing, but small, market for other salts.

▶ **Trends to Watch**—On the plus side: technology advances—and not only in ammonia synthesis. This year the practice of granulation—which usually goes hand-in-hand with high-analysis mixed fertilizers—really came into its own. Practically every major company in the business is using some granulation technique involving agglomeration with liquid mixes.

A granulated fertilizer is one in which each particle is relatively large and uniform in composition,

* The Florida phosphate strikes, which ended in October, tied up seven producers for four months. But this hasn't affected supply yet.

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Allied Chemical

*Trade Mark

although granulation is not confined to mixed goods. It's estimated that about 12% of the mixed goods in this country are granulated (2 million tons). This should jump at least 15% in 1956 because for many farmers the free-flowing, non-caking characteristics of granular fertilizers compensate for their slightly higher cost.

Another encouraging sign: the increasing use of fertilizer-pesticide mixtures. These are now used in 36 states, although Texas and New Jersey are against them as "not a proper method for controlling pests." And consumption is growing—from 10,000 tons in 1950-51 to 87,000 tons in 1952-53, 149,000 tons in 1953-54 and 200,000 tons in 1954-55.

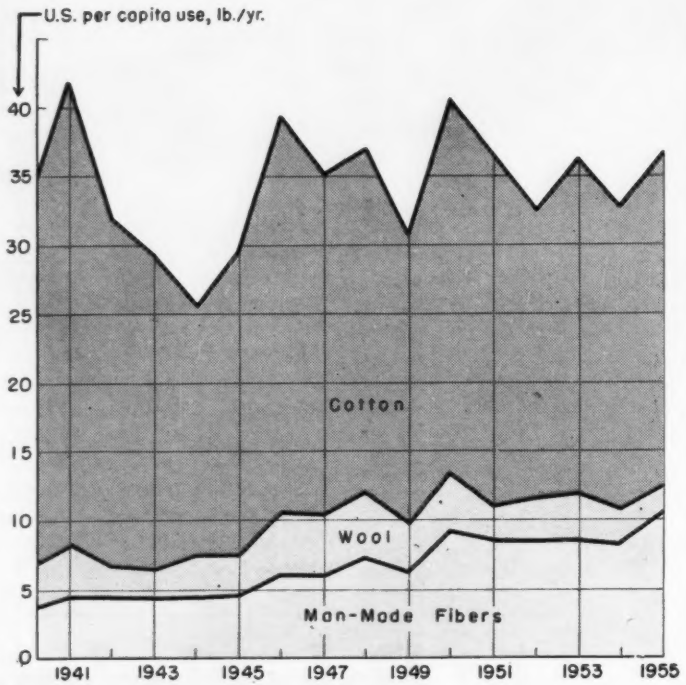
▶ **Disturbing Developments**—Of course, the general fertilizer picture looks good. But industry people look with apprehension at some disturbing developments on the farm. First, acreage allotments. Wheat was cut this year to the legal minimum—55 million acres. And next year other basics will be cut—4% for cotton, 15% for rice.

Actually these are not very drastic in themselves and have the initial effect of increasing fertilizer consumption. Farmers will buy more fertilizers to maintain a good level of income from the reduced acreage. (In fact, farmers had near-record harvests last year.) But eventually, if these cutbacks continue they will certainly cut down on over-all fertilizer consumption. Between 1953 and 1955, 36 million acres were taken out of production; 6 million more are expected to be taken out in 1956.

All in all the farmer was not happy in 1955. Farm incomes have been dropping steadily since 1951. Hugh surpluses have cut price supports. Examples: a 13% cut on wheat, 3% on cotton, all designed to encourage a reduction in farm production.

Over the long haul, though, the future is bright. According to J. A. Woods, president of Commercial Solvents:

". . . living standards will continue to rise, use of plant foods will continue to grow at the rate of about 6% annually, and by 1970 world consumption of fertilizer will double the amount used this year."




**Per Capita Use of All Fibers on the Rise**

Reversing last year's downward slide, all three major fiber groups—cotton, wool and synthetics—are having healthy increases in domestic per capita use this year, according to "Textile Organon."

Man-made fibers are hitting a new high, 10.5 lb. per person. This is up from 8.2 lb. in 1954 and 9.2 lb. in 1950, the best previous year. Per capita cotton consumption will be 23.2 lb. this year, better than 1954's 21.8 lb., but still well below the record set in 1941 of 33.5 lb. Wool use per person, only 2.6 lb. last year, will total 2.9 lb. in 1955.

## Big Growth Seen for Polyvinyl Acetate Paints

Look for sales of polyvinyl acetate paints to hit 50 million gal./yr. by 1960. They will be only 10 million gal. this year, but A. William Dunning, director of marketing for Shawinigan Resins Corp., predicts a five-fold rise in five years due to growing customer acceptance for both interior and exterior work and increasingly better products with wider application possibilities.

On the latter point, Dunning says that within the very near future there will undoubtably be developed a true one-coat interior polyvinyl acetate system, one that can be used over chalking oil paint.

## New Paper Uses Will Boost Consumption

Like synthetic fibers (*left*), consumption of paper per capita is rising and likely will continue to do so. In fact, according to Clem W. Kohlman, advertising manager of American Cyanamid's Industrial Chemicals Div., the rise will be sub-

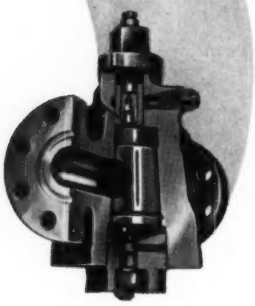
# Dependable

Rockwell-Nordstrom, *the* quality valve, is the most dependable valve you can use because it's *pressure lubricated.* Whether it is operated once a year or once every hour, the unique pressure lubrication system is always at work eliminating metal-to-metal friction, providing a leak-proof seal, and cushioning the plug for easy operation.

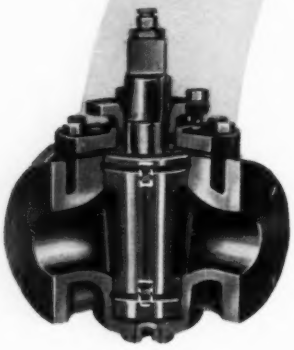
Rockwell-Nordstrom valves and plug valve lubricants are an investment you can always depend on for dividends in trouble-free service. Why not follow the leaders who have used Rockwell-Nordstrom valves for forty years? Rockwell Manufacturing Company, Pittsburgh 8, Pa.

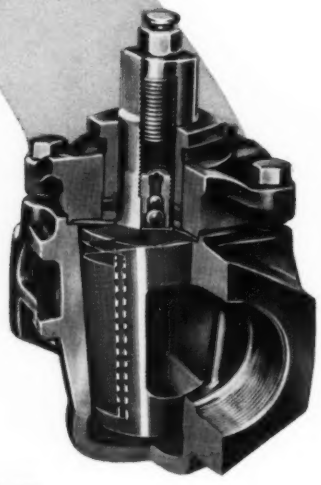
ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF



GASES





## Lubricant Sealing Holds Even the Lightest Gases

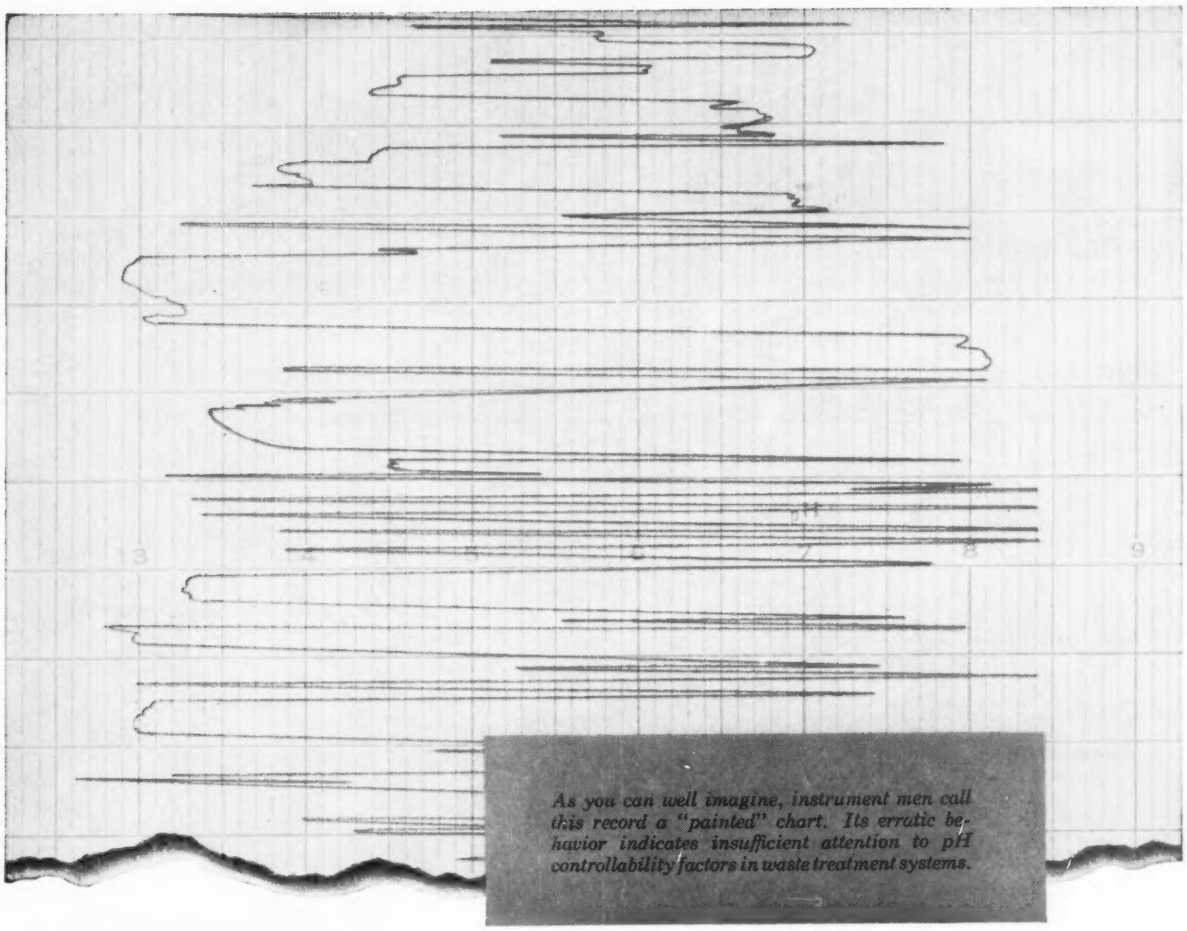
Rockwell-Nordstrom valves are the most efficient valves for any gas service because they're *lubricant sealed*. The unique Sealdport* grooves in the plug and body carry pressurized lubricant which forms a truly leak proof seal for the lightest hydrocarbons. Ordinary valves depend solely upon risky metal-to-metal closure where one tiny scratch means a leak.

Whatever your gas control problems, there is the perfect combination of Rockwell-Nordstrom valve and lubricant to do the job more dependably and economically than any other valve you've ever used. Write on your letterhead today for full details. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

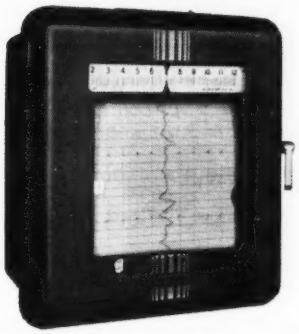
*a registered trademark of Rockwell Manufacturing Company

# ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF



*As you can well imagine, instrument men call this record a "painted" chart. Its erratic behavior indicates insufficient attention to pH controllability factors in waste treatment systems.*



**FOR EFFICIENT WASTE TREATMENT**

# don't "paint" the chart!

**In Any Given Waste Treatment System,** the factors governing pH controllability—type of waste, variations in flow and concentration, layout and retention of the system, etc.—determine operational success. A painted chart may indicate that a system has been designed and instrumented without due regard to these factors, a regard which only L&N's pH Controllability Analysis provides.

This unique Analysis gives us vital information about the controllability factors of individual waste treatment processes. Our engineers analyze these data to determine the limits within which the process can be controlled in a proposed treating system, or to recommend the physical layout needed to gain the desired degree of control— the answers you need to achieve efficiency in industrial waste treatment.

Process Data Sheet 700(2), "L&N Speedomax Control of Plant Waste Disposal Processes", outlines this approach to industrial waste treatment. Write for a copy and you'll also receive a Controllability Analysis Questionnaire to fill out and return, without obligation, for concrete answers to your specific waste treatment problem. The address—4916 Stenton Ave., Phila. 44, Pa.

LEEDS NORTHRUP
*instruments* *automatic controls* • *furnaces*

**ECONOMICS . . .**

stantial. Pegged now at 393 lb./person, by 1980 it will be 1,000 lb./person.

Major impetus for this increase are the new markets for paper, particularly as substitutes for textiles in apparel. New types of paper for automatic recording devices—keys to the current and upcoming boom in automation—are a second expanding market.

Among the products that could well be made of paper instead of textiles, largely because of the successful development of wet-strength resin, Mr. Kohlman cites these: raincoats, bathing suits (particularly those rented at public beaches), scholastic caps and gowns, aprons, hats, skirts, dresses, underwear, socks and shoes.

## GUIDED TOUR CONTINUED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### Making a hazardous chemical

The chemical is ammonium perchlorate. But there is "know-how" information here on reactor design and materials of construction, in addition to a process description of Wecco's new plant. (p. 334)

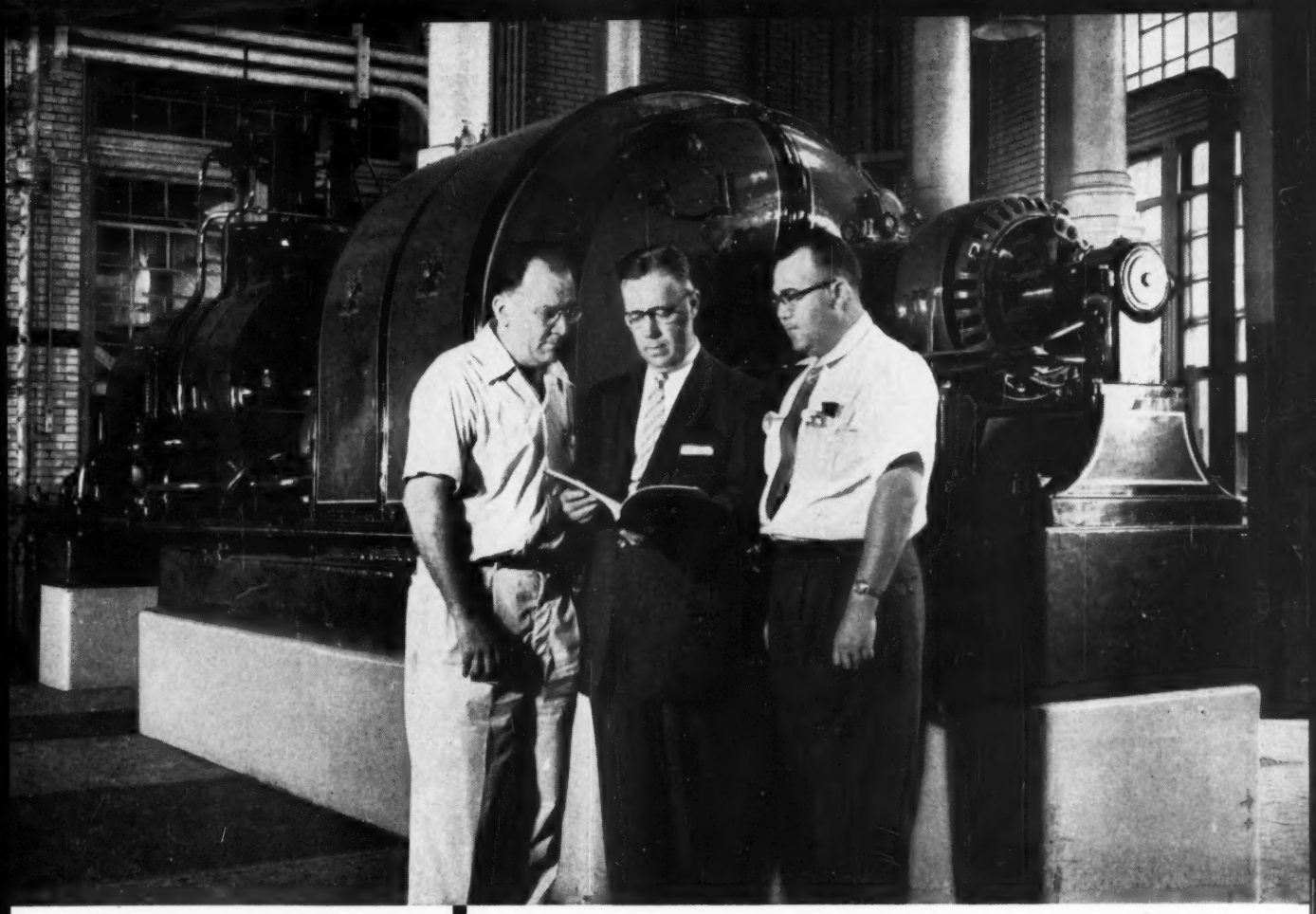
### Find it hard to keep up?

Maybe you should keep closer tabs on new reference books coming out. Technical Bookshelf is your monthly guide. (p. 356)

### New technical literature!

You can now get—free and fast—literature on any subject in your field. Keep your files up to date the easy way.

**Join READER SERVICE**
**Inside Back Cover**



E. A. Hamann (left), Power Generation Engineer and Robert Best (right), Superintendent of Utilities, go over lubrication records with Bill Schall, Standard Oil lubrication specialist. Bill Schall has been providing technical sales service to Standard Oil customers since 1943. Bill is an engineer with a B.S. in engineering from Georgia Tech., and a graduate of Standard's Sales Engineering School. Customers of Bill's find this experience and background pay off *for them.*

# *Anheuser-Busch still using same turbine oil after 24 years*

# ...NONPAREIL

For more than 24 years the Anheuser Busch Brewery, St. Louis, Mo., has been operating two 3,000 kw., turbines using NONPAREIL Turbine Oil. Three more turbines added to the system in 1940, '48 and '51 have also used NONPAREIL since beginning operations. The reason for choosing NONPAREIL is clear; it is guaranteed for the life of the turbine.

Since the initial installation, Anheuser Busch has not had to replace a NONPAREIL Turbine Oil fill. Neutralization number is always far below 0.15 mg. KOH/g., the degree of acidity Standard Oil guarantees NONPAREIL will not exceed. At nearly all times neutralization number is on the order of 0.03 mg. KOH/g. (See chart).

In all these years, oil systems have remained clean. There has been no problem of oil acidity in any of the five turbines. The delicate art of brewing world famous Budweiser goes on without concern over power failure due to lubrication failure.

Like to know more about NONPAREIL and its possible use in your turbines? In the midwest call your nearby Standard Oil lubrication specialist. Or, contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

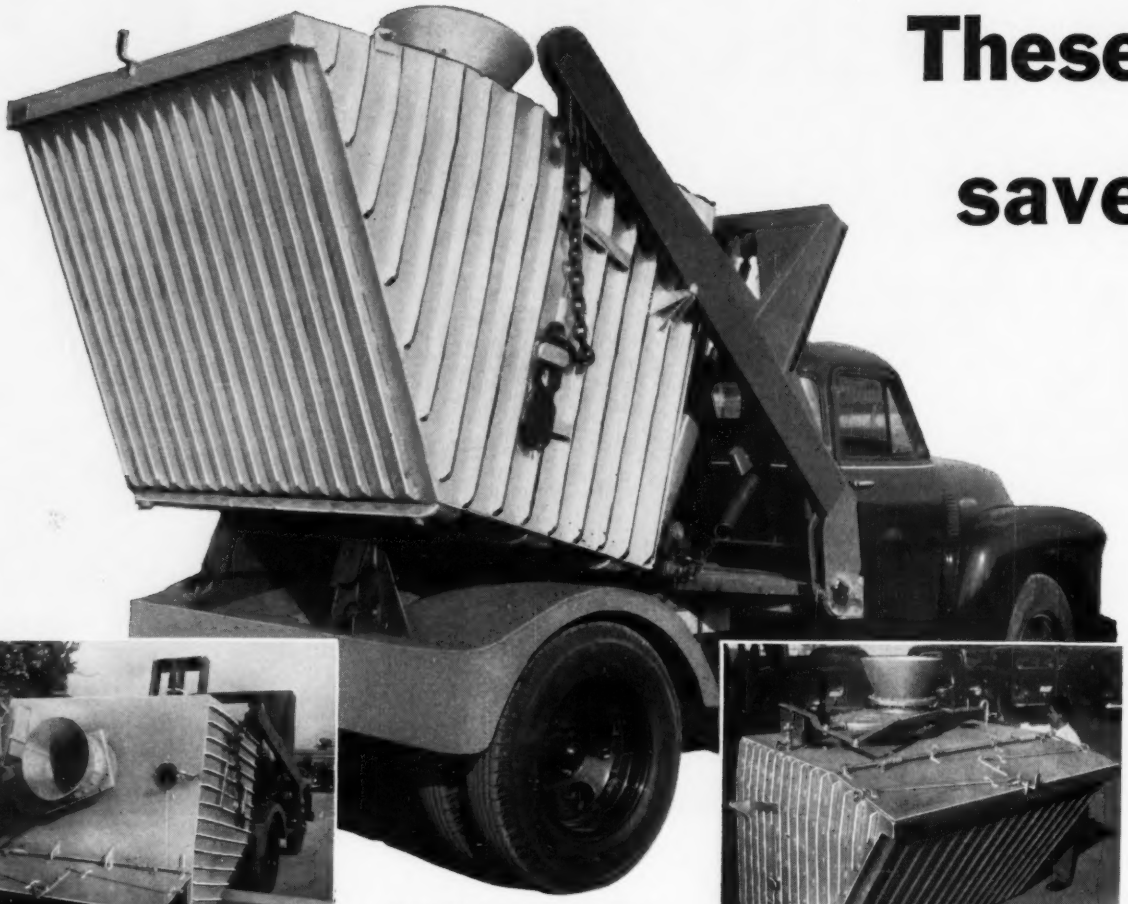
**Anheuser-Busch Turbine Lubrication Record**

| Generator Capacity | Start up and NONPAREIL Installation Date | Date of Last Oil Analysis | Neutralization Number |
|---|---|---|---|
| 3,000 kw. | Oct. 2, 1930 | July 20, 1954 | 0.03 |
| 3,000 kw. | Oct. 2, 1930 | July 22, 1954 | 0.02 |
| 2,500 kw. | June 10, 1940 | July 20, 1954 | 0.03 |
| 7,500 kw. | Jan. 2, 1948 | July 22, 1954 | 0.03 |
| 7,500 kw. | July 26, 1951 | July 22, 1954 | 0.01 |

STANDARD

**STANDARD OIL COMPANY**
(Indiana)

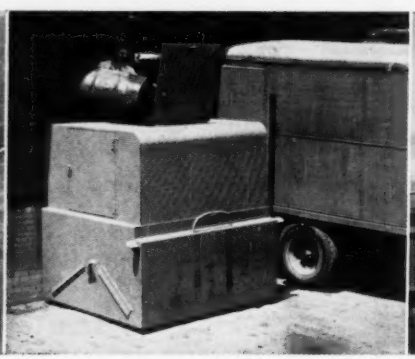
# These save



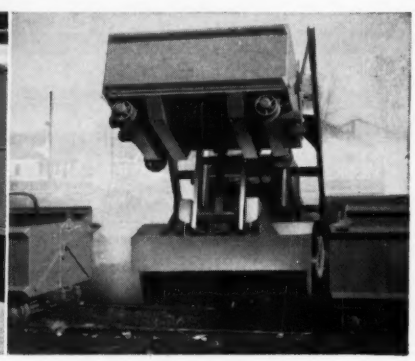
Dempster-Dumpster serving a 6 cu. yd. container with cooling fins for handling a high temperature product.

Here are a few of the hundreds of Detachable Containers we have built to solve handling problems of every description. A few others not shown include those with compartments . . . with insert containers . . . fully-insulated . . . lined with lead . . . lined with fire brick . . . with windows and doors . . . with casters . . . flat bottoms and open at one end . . . with teeth . . . with shelves for tools and supplies—and we could describe hundreds more, all served by one Dempster-Dumpster and only one man, the driver.

This 3 cu. yd. Container has skids for fork lift truck transfer.



10 cu. yd. Container widely used for refuse and combustible wastes.



Flanged wheel equipped containers for remote loading.

5176

**DEMPSTER**

# 4 manufacturers to $82,000.00 annually handling waste materials!

## These four industrial plants expect to save, in labor costs alone, during the first five years service of the Dempster-Dumpster System—

A PLASTICS PLANT: $26,958.00 savings on an investment of $9,523.50 in Dempster-Dumpster equipment. Savings alone pay for equipment in two years.

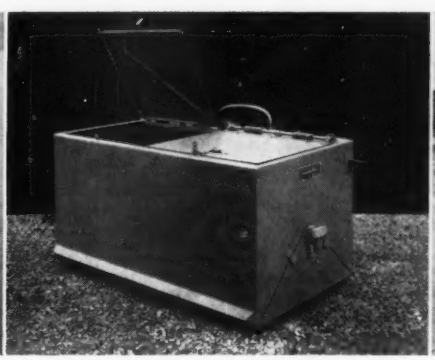
A CHEMICAL PLANT: $204,076.75 savings on an investment of $40,968.00 in this equipment . . . savings pay for equipment in one year.

AN AUTOMOTIVE PLANT: $135,000.00 savings on an investment of $19,272.00 . . . savings pay for equipment in 9 months.

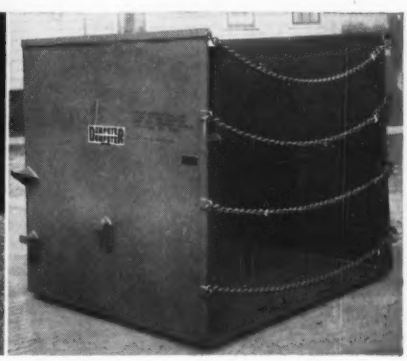
A PAPER AND PULP MILL: $43,104.00 savings on an investment of $10,750.00 . . . savings pay for equipment in 1¼ years.

Those are typical examples. Visualize a Dempster-Dumpster, operated by only one man, the driver, serving scores of big steel containers, one after another, in your plant. Containers of many designs and types, handling waste or salvable materials, raw or finished products, fluids including acids, combustibles, dusty materials—anything that can be handled in up to 21 cu. yd. detachable Dempster-Dumpster Containers . . . payloads up to 19 tons. Savings are tremendous! Take advantage of our free engineering service, which determines by fact-finding survey the cost cutting possibilities of this system in your plant. Dempster Brothers, Inc.

600 Gal. stainclad tank with brine cooling channels.



A Container available up to 10 cu. yds. with or without lids for many uses.



A 9 cu. yd. container for handling packaged products.

**BROTHERS** 2125 Dempster Bldg., Knoxville 17, Tenn.

# HOW HERCULES HELPS...

**AN INCREASED SUPPLY** of para-cresol, raw material for antioxidants used in gasoline and rubber, will become available late in 1956 with the completion of the recently announced addition to Hercules' oxychemical plant in Gibbstown, N. J. This will more than double the amount now being produced by Hercules and is the sixth product to be made commercially by the Hercules' oxidation process. Para-cresol also plays an important part in the production of essential oils and in the manufacture of dyes.

**FASTEST DRYING** of all protective coatings, lacquer is ideally suited to keep pace with today's mass production methods. At the Standard Box Company in Pittsburgh, for example, a single-application hot-lacquer system protects beverage boxes with no delays for drying. Hercules works closely with the coatings industry in developing and perfecting new uses for lacquer-type coatings based on its nitrocellulose, ethyl cellulose, cellulose acetate, and Parlon® (chlorinated rubber).

**ACID, ALKALI, AND WATER** are all repelled when paper or paperboard are sized with Hercules Aquapel®. In corrugated cartons or spiral wound fiber drums where alkaline glues are used, Aquapel sizing effectively retards penetration of the glue. Neither a resin nor a wax, Aquapel is a chemical that reacts with the cellulose fiber to form a surface that is resistant to hot and cold water, acid or alkali. That's why so many paper mills are finding ever-increasing use for this new sizing agent.

HERCULES

CHEMICAL MATERIALS FOR INDUSTRY

*HERCULES POWDER COMPANY*
INCORPORATED
*952 Market St., Wilmington 99, Del. Sales Offices in Principal Cities*

SYNTHETIC RESINS, CELLULOSE PRODUCTS, CHEMICAL COTTON, TERPENE CHEMICALS, ROSIN AND ROSIN DERIVATIVES, CHLORINATED PRODUCTS, OXYCHEMICALS, EXPLOSIVES, AND OTHER CHEMICAL PROCESSING MATERIALS.

G55-11

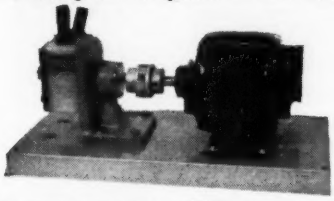
# CORPORATION BRIEFS

## TECHNICAL DATA ON STAINLESS STEEL VALVES

A twelve-page technical data booklet covering stainless steel valve design, selection, maintenance and repair has just been announced by our Valve and Fitting Division. Printed to form part of the new catalog, the technical section is being offered separately on request. Photographs, engineering drawings and cut-a-ways combine to make this a very complete, yet condensed, discussion of stainless valves. *Ask for Bulletin VTD.*

## PUMPING 65% HF AND 40% $H_2SO_4$

No stuffing box! No gasket! No shaft seals!

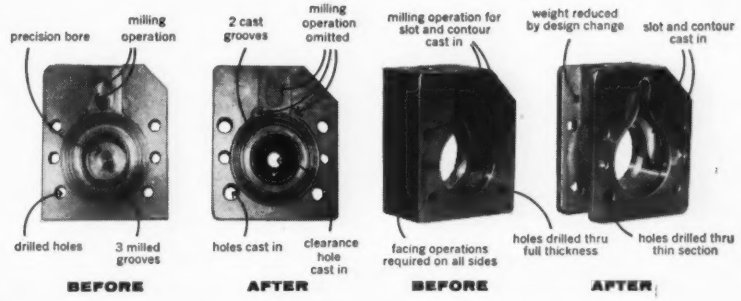


Pumping 65% HF is tough enough, but when service requirements also include 40% $H_2SO_4$ the problem is really rough. An alert primary metals producer found the answer by replacing two conventional pumps with a Vanton "flex-i-liner" self priming pump and two alternate liners. Model PX60-10 gpm—with a polyethylene body block, a gum rubber liner for the HF and a neoprene liner for the $H_2SO_4$ did the trick. Two trouble free plastic pumps in one!

When it comes to pumping those tough corrosive liquids and abrasive slurries, there's no pump like a Vanton!

*Catalog VP 55 on request.*

## IN CASTING PUMP PARTS, *ADVANCED KNOW-HOW* MAKES THE DIFFERENCE




Machining time on the stainless steel housing for the Vanton "flex-i-liner" pump was cut from 14 hours down to 2 through the use of shell cores; weight was reduced and drilling simplified through casting redesign; and the use of shellcast® eliminated the milling on the end plates, making it economical to produce them in stainless steel instead of aluminum. This resulted in a better product in less time and for less money thanks to Cooper Alloy *Advanced* Know-How.

*For Full details on this specific application write for free copy of case study #2.*

## *QUIKUPL*® Cuts Costs on Vinegar Lines

It's been almost two years since Edward Parish of Standard Products Company in Philadelphia specified QUIKUPL ells, tees and unions for his 1½" hot and cold vinegar lines, but he still keeps talking about the fact that the installation was made without the plumbing tool complement usually required for setting in such a line.

"We had the lines in so fast that it was hard to believe—and the time and labor saving repeats itself at our frequent clean-out and internal inspection periods," Mr. Paris told us. "Before using QUIKUPL it was necessary to silver solder and braze all plumbing joints running from the orifice of the outside vinegar storage tanks through the filtration system hookup and the pasteurizer to the filling machine. QUIKUPL dismantling and erection time is considerably less than that required by our old method —and that means less shut-down and less labor."

The vinegar processing system operates alternately at room temperature and 180° F.

## BOOTH 602 AT THE CHEM SHOW

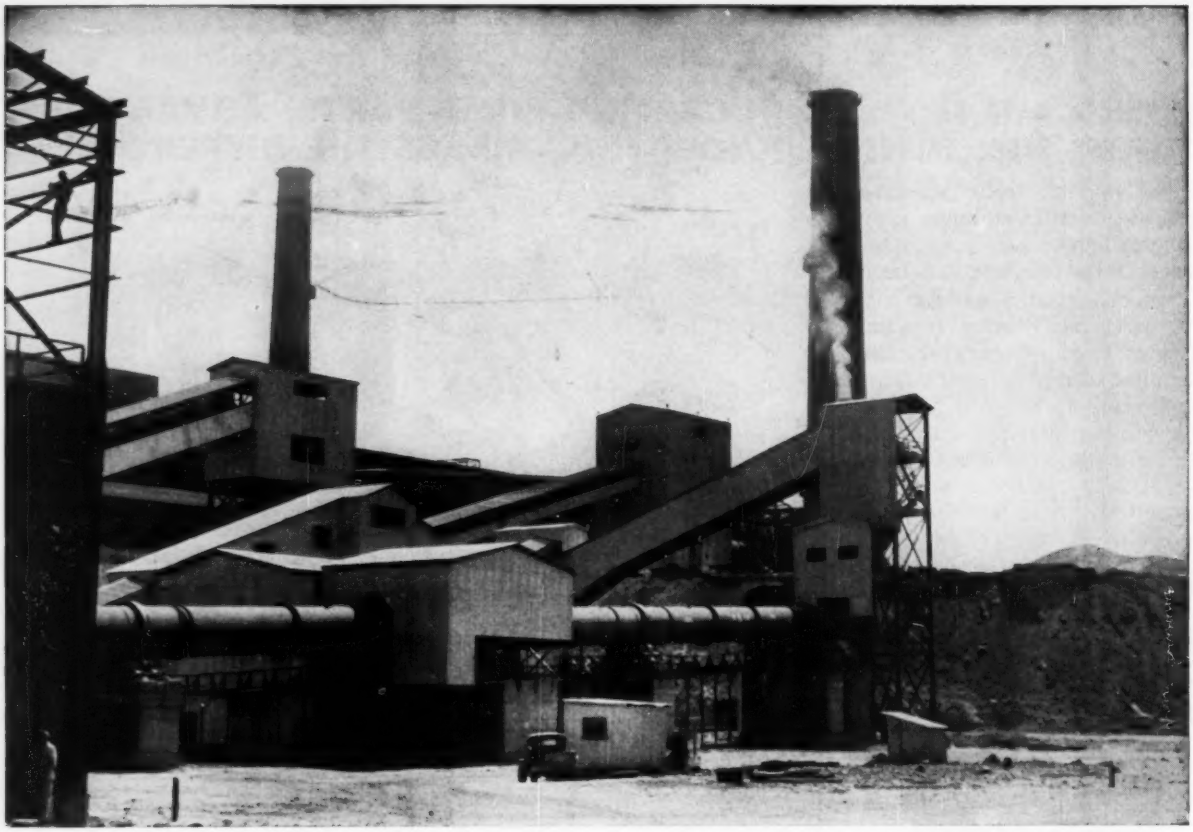
Three hundred and sixty square feet of exhibit space referred to as Booth 602 will be devoted to telling how Advanced Know-How makes the difference in corrosion resistant Castings, Valves, Fittings and Pumps. There will be plenty of products on display, plus working and cut-a-way models. Our key people will be on hand to greet you and assist in any way possible. We hope you'll stop by.

**COOPER ALLOY**
CORPORATION · HILLSIDE, N. J.

*Divisions:*
FOUNDRY PRODUCTS DIVISION · VALVE & FITTING DIVISION · VANTON PUMP & EQUIPMENT CORPORATION
STAINLESS ENGINEERING AND MACHINE WORKS DIVISION · AIRCRAFT PRODUCTS DIVISION

# 6 miles of "know-how"

## offer a short-cut to profitable thermo-processing



## OVER 150 TRAYLOR KILNS are your best assurance of an efficient installation

Traylor has built over 150 Rotary Kilns since 1941 . . . an average of almost one a month for 14 years. Their combined length is over 33,000 feet. This adds up to more than 6 miles of kiln building "know-how" for Traylor.

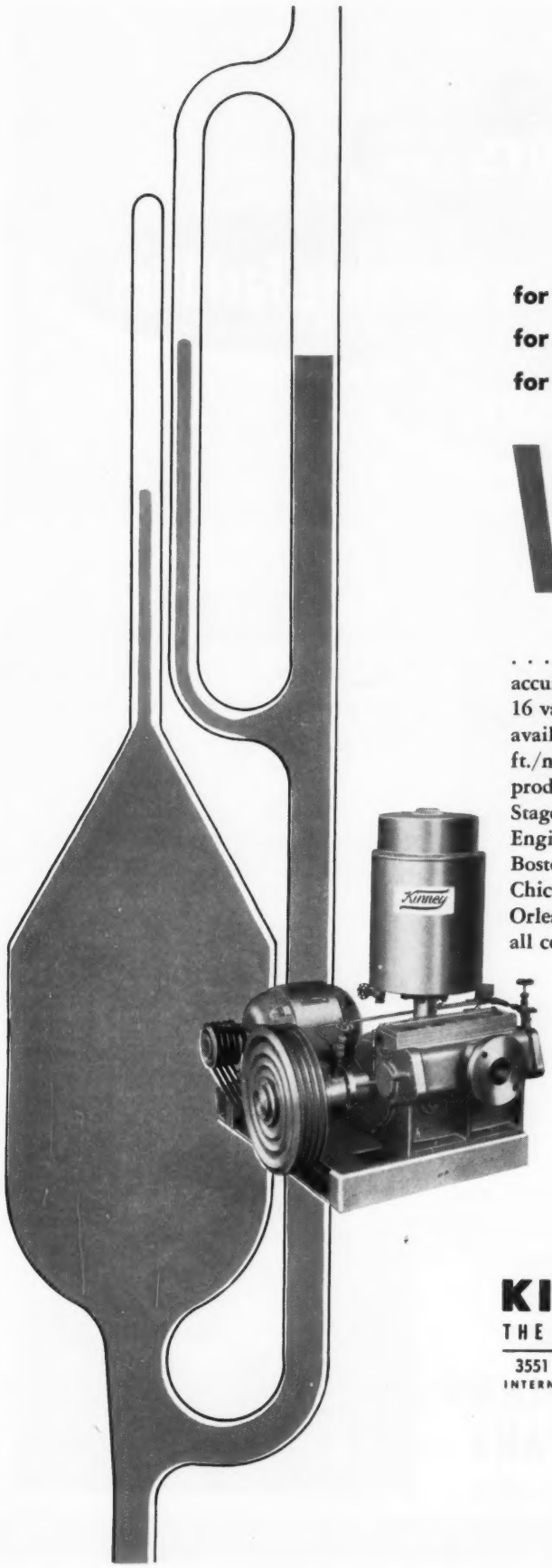
Kilns have been "Traylor-made" for processing some 21 different products. The answer to many new thermo-processing problems has been found in Traylor's accumulation of kiln-building experience. If you are responsible for efficient thermo-processing in your plant, take the short cut to a profitable installation. Avoid the long costly way of trial and error. Have a kiln "Traylor-made" for the job. Write for bulletin 1115 today.

**TRAYLOR ENGINEERING & MFG. CO.**
**1711 Mill St., Allentown, Pa.**
**Canadian Mfrs.: Canadian Vickers, Ltd., Montreal, P. Q.**

A Traylor leads to greater profits

*SEND FOR BULLETINS*
*. . . just mention the Traylor Equipment that interests you.*

SALES OFFICES · NEW YORK · CHICAGO · SAN FRANCISCO




**for Research . . .**

**for Development . . .**

**for Production . . .**

# VACUUM

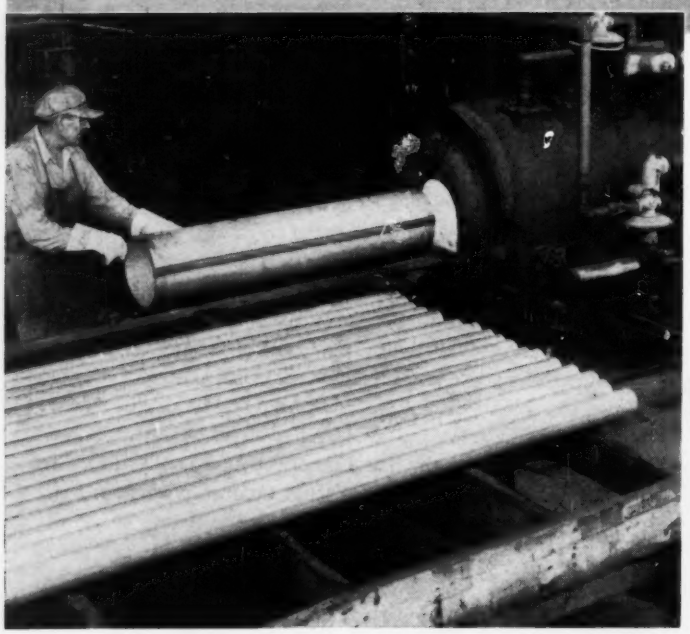
. . . created and maintained at required levels swiftly, accurately, consistently by Kinney High Vacuum Pumps. 16 vacuum pump models, single stage and compound, all available for gas ballasting. Capacities range from 2 cu. ft./min. to 1230 cu. ft./min. Kinney Compound Pumps produce low absolute pressures to 0.0002 mm Hg . . . Single Stage Pumps to 0.010 mm Hg. Consult Kinney for Vacuum Engineering data and recommendations. District Offices in Boston, New York, Philadelphia, St. Louis, Cleveland, Chicago, Charleston, W. Va., Detroit, Houston, New Orleans, Pittsburgh, San Francisco, and Los Angeles are all competently staffed to discuss vacuum with you.

**KINNEY** MFG. DIVISION
THE NEW YORK AIR BRAKE COMPANY
3551 WASHINGTON STREET • BOSTON 30 • MASS.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N.Y.

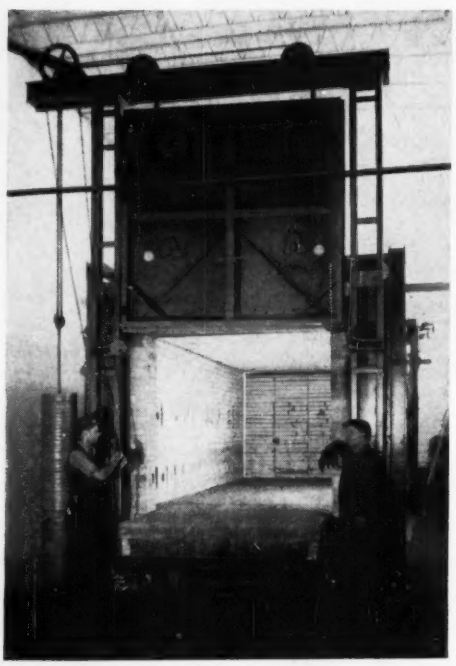
# WELDCO offers...

## Complete Annealing Facilities

## For Unlimited Tubing Sizes



WELDCO continuously anneals 3" to 12¾" stainless steel tubing through a conveyor-type gas-fired furnace with a water spray quench.



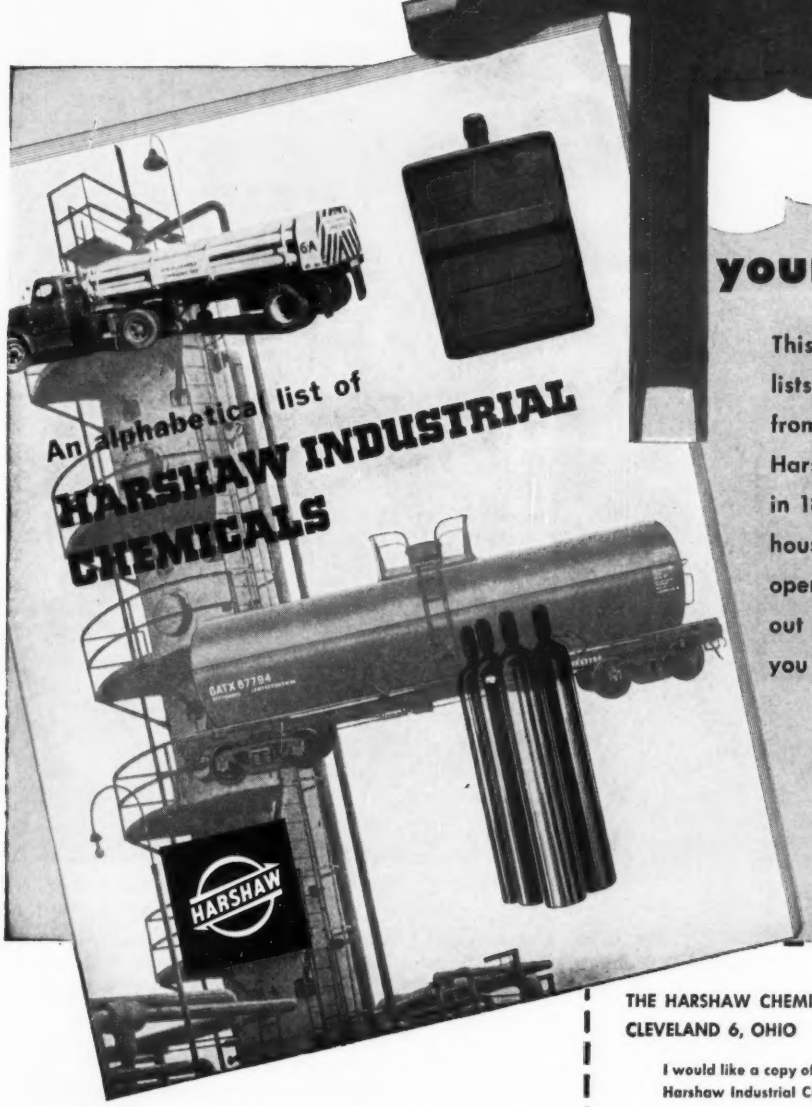
Large diameter and heavy-walled pipe are annealed in this Car-type annealing furnace. Diameters unlimited.

*Write today for complete information and free literature.*

**THE YOUNGSTOWN WELDING AND ENGINEERING COMPANY**

**3708 OAKWOOD AVE. YOUNGSTOWN 9, OHIO**

# write for your free copy




This 24-page booklet alphabetically lists the many chemicals available from Harshaw. Read the story about Harshaw's growth since its beginning in 1897. Pictures of plants, warehouses, research and manufacturing operations are scattered throughout the book. We will gladly send you a copy if you write.

**THE HARSHAW CHEMICAL CO.**
CLEVELAND 6, OHIO

Chicago • Cincinnati • Cleveland • Detroit • Houston • Los Angeles
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THE HARSHAW CHEMICAL CO.
CLEVELAND 6, OHIO

I would like a copy of your free booklet "An Alphabetical List of Harshaw Industrial Chemicals."

MY NAME _____

COMPANY NAME _____

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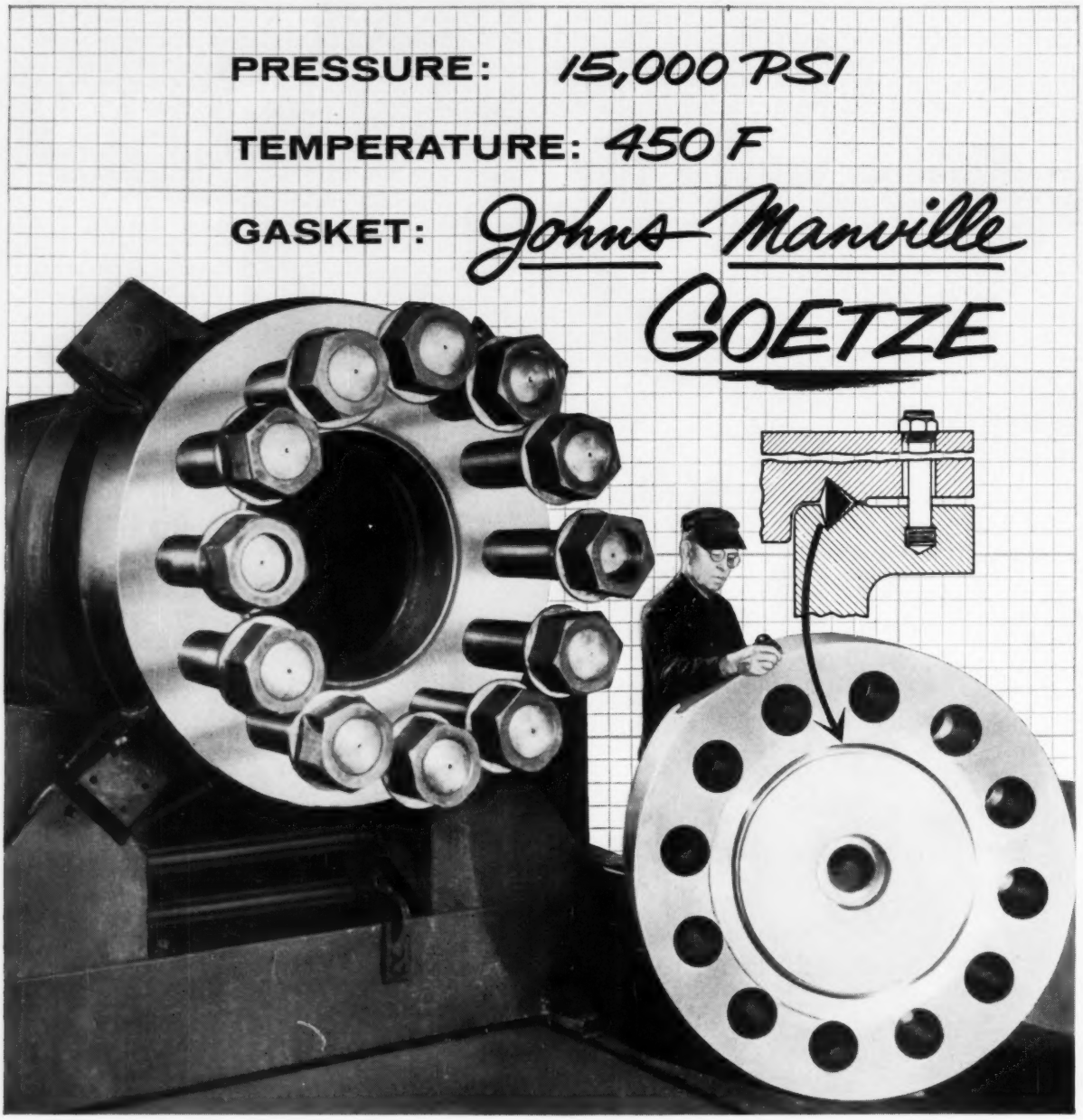


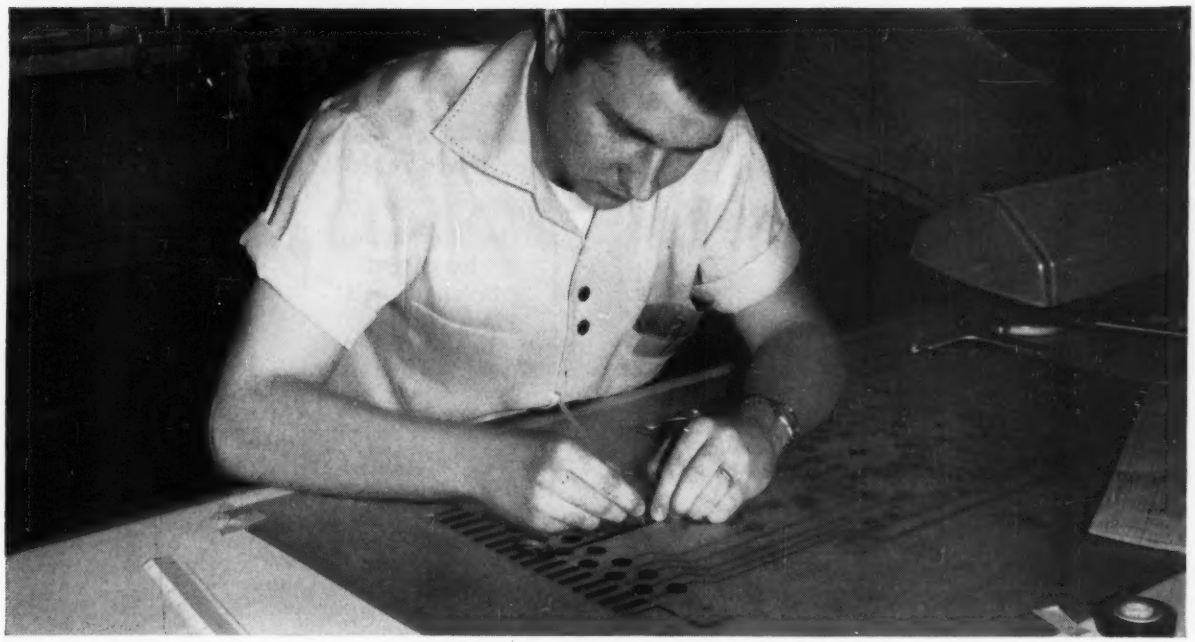

**How A. O. Smith maintains tight seals in giant "Multi-Layer" vessels**

Today's tremendous pressures and temperatures have placed special demands on manufacturers of processing equipment. A. O. Smith has answered this need with a special type of "Multi-Layer" vessel construction. And Johns-Manville in turn has provided gaskets that assure tight seals under these exacting conditions. Typical of these is the delta type gasket, illustrated above, which was designed, for this application, to withstand pressures up to 15,000 psi. and temperatures to 500 F.

The development of special gaskets to meet special purposes has been the stock in trade of Johns-Manville's Goetze division for more than sixty-five years. Expert technicians possess a knowledge of metals and other factors related to gasket design and performance that is unmatched in the field. What's more, intensive specialization and modern production tooling provide substantial cost savings on J-M gaskets.

If you need gaskets for high pressure vessels for similar applications, send us a drawing or template for quotation. If you have a sealing problem of any kind, J-M technicians will work directly with your own engineers to develop new gaskets —or adapt existing styles—to meet your specific requirements. Write for further information to Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

**Johns-Manville PACKINGS & GASKETS**



Short cuts speed printed-circuit design at Brush Electronics Co.

# "3-day job"...done in 3 hours

**Brush Electronics Co., a Division of Clevite Corp., Cleveland, Ohio, finds countless uses for photographic materials and techniques in designing more than 700 products.**

Take the draftsman working on that printed-circuit diagram, for example. The original practice was to draw such circuits in ink on heavy Bristol board.

Now, the job is done in a fraction of the time by positioning precut circles and lines, with adhesive backing, on a form. This is reproduced on Kodagraph Autopositive Film, a positive copy being obtained directly without a negative step. This reproduction—with dense black photographic lines on a translucent base—is sent to the vendor who makes the printed circuits.

Brush has also found that duplicate tracings, made quickly and economically on roomlight-handling Kodagraph Autopositive Paper or Film, are the key to further savings when drawings must be revised, or vendor prints reproduced. Such duplicates are continually being used in place of originals for reference and print making . . . are protection against possible loss or unavailability of the originals.

And Brush further streamlines drafting and engineering activities with the help of other Kodak materials—uses Kodagraph Contact Fine-Line Paper for revising and combining drawings, and making high-quality offset plates . . . uses Kodalith Film in preparing "pictorial" assembly drawings, reduced-size drawings, handbook pages, graphs. *Sometimes four or five materials are used on one job, for top-quality results and savings at every step.*

To learn the ways Kodagraph and other Kodak reproduction materials can serve you, just mail coupon below, or get in touch with your local blueprinter.

## Kodagraph Reproduction Materials

**New booklet** is jam-packed with valuable tips on saving drafting time, protecting drawings, getting better prints.

MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY 105
Graphic Reproduction Division, Rochester 4, N. Y.
Gentlemen: Please send me a free copy of your new booklet on Kodagraph Reproduction Materials.

Name_____ Position_____

Company_____

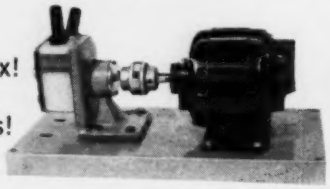
Street_____

City_____ Zone_____ State_____

Kodak
TRADE-MARK

THE PROBLEM:
**PUMPING SULPHURIC ACID**
THE SOLUTION:
**VANTON PLASTIC PUMP**

No stuffing box!
No gasket!
No shaft seals!



A leading producer of welding gas had the problem of transferring concentrated sulphuric acid (93%) from storage to process tanks. The pump had to operate 6 to 10 hours daily and deliver 10 gpm against a 15 ft. head. The answer was found in a Vanton "flex-i-liner" pump, model PX60, with its polyethylene body block and hypalon flexible liner.

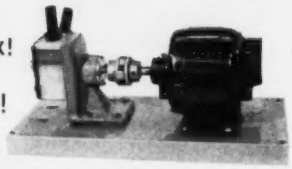
If you're troubled with pumping corrosive or abrasive liquids and slurries, get the facts on the Vanton "flex-i-liner."

Catalog 55 on request.

**VANTON**
PUMP & EQUIPMENT CORP.
201 Sweetland Ave. Hillside, N. J.
division of Cooper Alloy Corporation

The Problem:
**PUMPING HYDROCHLORIC ACID**
The Solution:
**VANTON PLASTIC PUMP**

No stuffing box!
No gasket!
No shaft seals!



A large producer of industrial chemicals, seeking a portable carboy transfer unit for pumping concentrated HCL, solved his problem with a self priming Vanton "flex-i-liner" pump, Model XB-P30 (5 GPM). The polyethylene body block and Hypalon "flex-i-liner" are the only materials in contact with the fluid, and the design eliminates stuffing boxes and shaft seals. Pump and base are mounted on casters for portability. Maintenance has been reduced to annual replacement of the inexpensive "flex-i-liner".

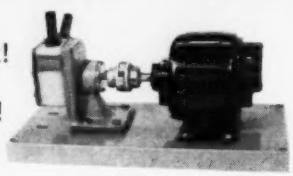
For pumping corrosive fluids, abrasive slurries, and fluids which require no contamination, Vanton is a natural.

Catalog 55 on request.

**VANTON**
PUMP & EQUIPMENT CORP.
201 Sweetland Ave. Hillside, N. J.
division of Cooper Alloy Corporation

The Problem:
**PUMPING FERRIC CHLORIDE**
The Solution:
**VANTON PLASTIC PUMP**

No stuffing box!
No gasket!
No shaft seals!



A major manufacturer of electronic equipment faced the problem of transferring corrosive ferric chloride in the new Printed Circuit department to and from the etching machine, located 40 ft. from the pump unit. It was solved by using a Vanton pump, Model NX-90 (15 GPM) with Buna N body block and Natural Rubber "flex-i-liner". Since the Vanton operates equally well in either direction, a reversing switch on the motor made possible ready changes in the direction of flow.

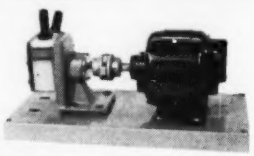
When the problem involves corrosive or abrasive solutions or slurries, the sealess, self priming, no stuffing box Vanton is the answer.

Catalog 55 on request.

**VANTON**
PUMP & EQUIPMENT CORP.
201 Sweetland Ave. Hillside, N. J.
division of Cooper Alloy Corporation

The Problem:
**PUMPING ABRASIVE SLURRIES**
The Solution:
**VANTON PLASTIC PUMP**

No stuffing box!
No gasket!
No shaft seals!



A foremost manufacturer of ceramic wall tiles had the problem of transferring extremely abrasive ceramic tile glaze from drums, where the glaze was mixed, to storage tanks. This heavy and extremely abrasive slurry had quickly destroyed mechanical seals and packing in ordinary pumps and rapidly wore rotating parts. A Vanton Pump Model NX-120 (20 GPM) with Buna N body block and Natural Rubber "Flex-i-liner" readily solved this problem reducing maintenance costs to a minimum.

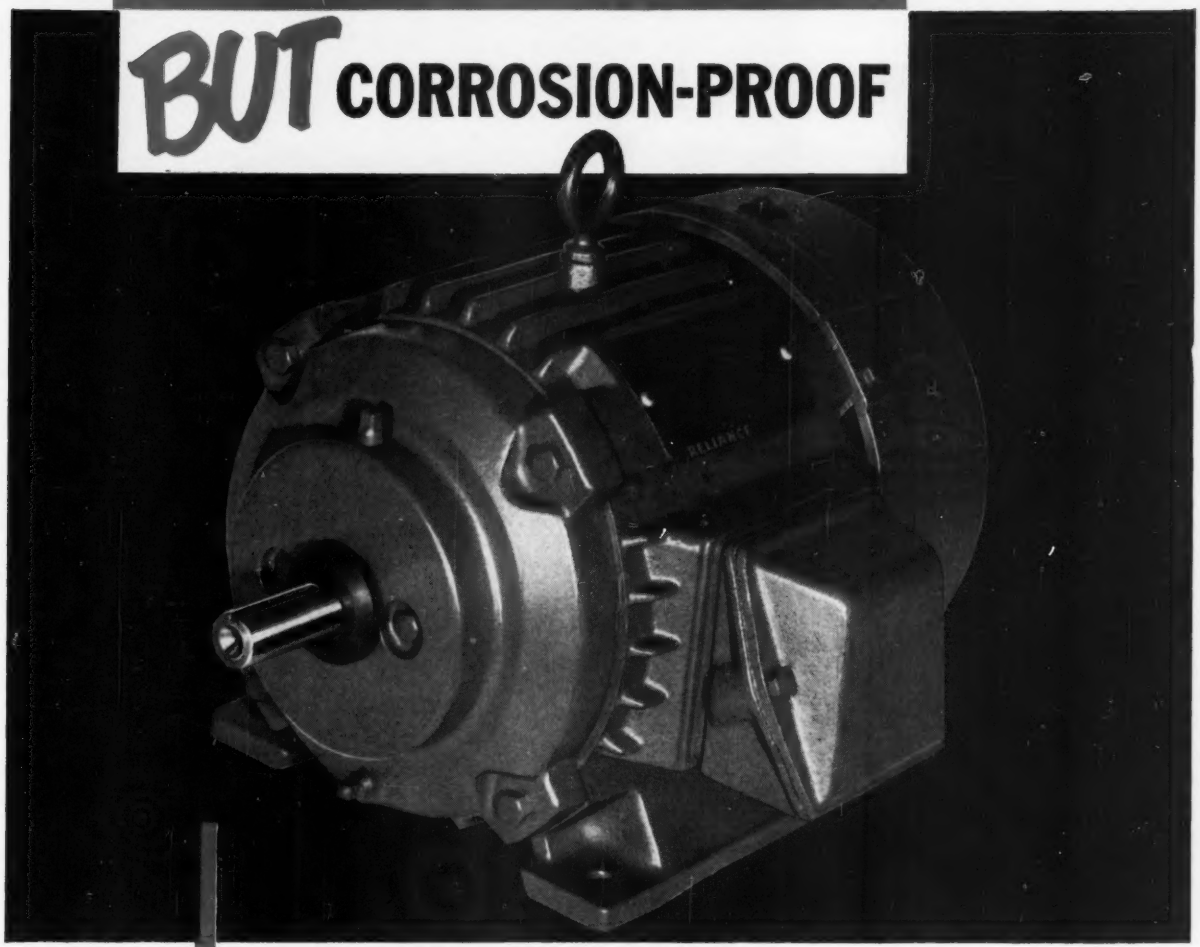
Whether the problem be one of handling abrasive slurries, corrosive solutions, or fluids which must be maintained contamination free, investigate the use of the Vanton "Flex-i-liner" pump.

Catalog 55 on request.

**VANTON**
PUMP & EQUIPMENT CORP.
201 Sweetland Ave. Hillside, N. J.
division of Cooper Alloy Corporation

# Not Just CORROSION-RESISTANT

# BUT CORROSION-PROOF



Corrosion resistance is not enough to stop acids or alkalies from chewing up a motor in a hurry. That is why the wise engineer selects Reliance Corrosion-Proof Motors for corrosive service.

These motors are built to withstand the onslaught of destructive chemicals for years. Housings are made of virtually indestructible cast iron. Exterior contours are designed to slough off liquids—no nooks and crannies to retain corrosive elements. Enclosures are sealed to prevent any leakage . . . Metermatic lubrication systems provide complete protection against burned out bearings and contaminated lubricants.

Anyway you look at them, Reliance Corrosion-Proof Motors can take it—and you're not limited in the choice of motors either. A complete line of a-c. motors, 1 thru 300 hp., is available in all mountings, frequencies and voltages.

Why not call your Reliance representative today and get all the details.

B-1505

RELIANCE Totally-Protected MOTORS

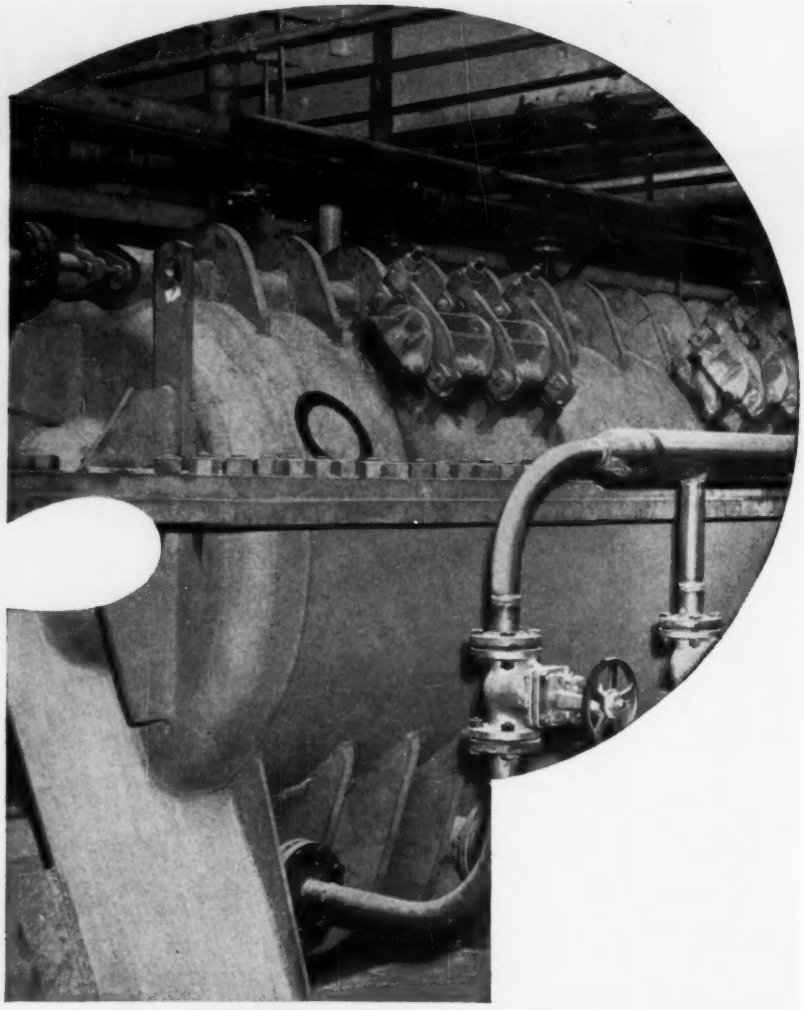
**RELIANCE ELECTRIC AND ENGINEERING CO.**

**Cleveland 10, Ohio • Offices in Principal Cities**

***Canadian Division: Welland, Ontario***

# We'll GUARD your Confidential Process Problems...

***while we help you solve them!***



If it's a **FILTERING OR EVAPORATING PROBLEM** —and a tough one... it will Pay you to talk to **G-B**

***G-B engineers*** **have a wealth of filtering and evaporating "KNOW-HOW" you can use. They will consult with you,** ***without obligation,*** **to help you solve your problems. They will help you run tests in your own plant . . . or you are welcome to use G-B's own complete testing facilities.**

**GB**

**GOSLIN - BIRMINGHAM MANUFACTURING CO., INC.**

BIRMINGHAM • ALABAMA

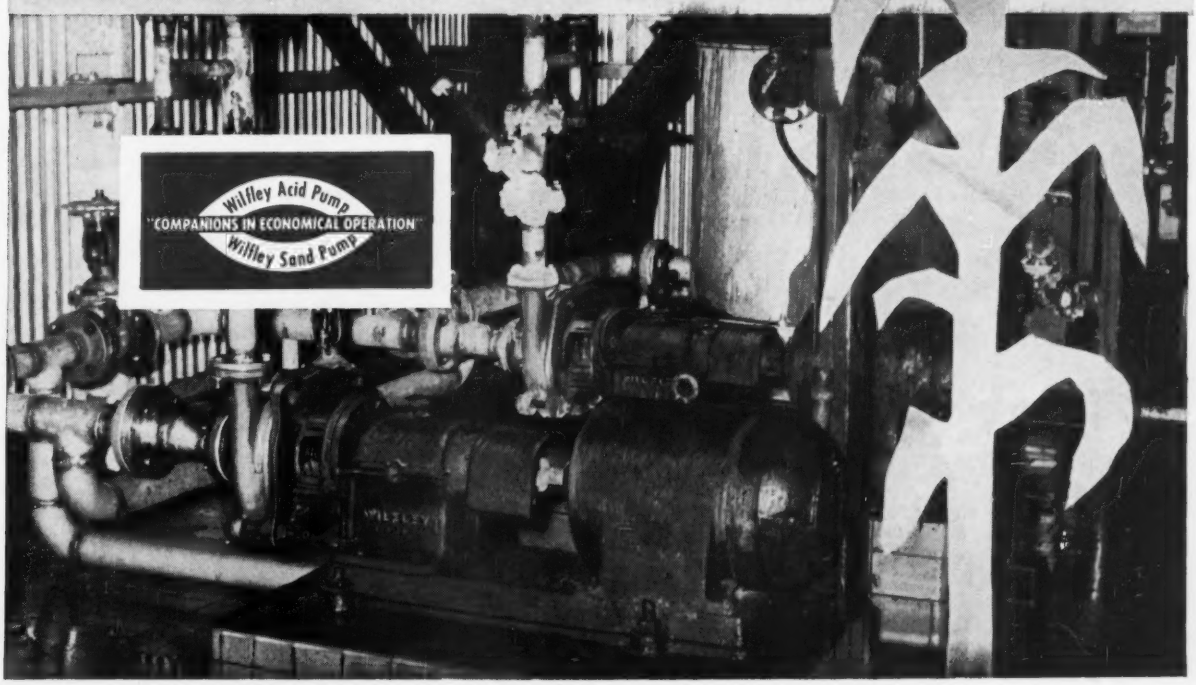
# WILFLEY

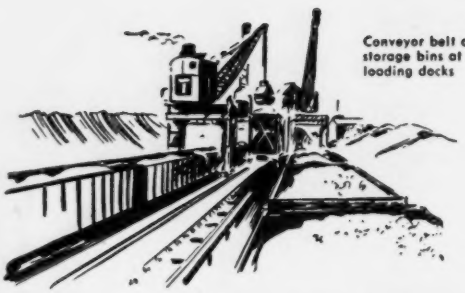
## helps the corn grow tall!

Fertilizer is one of the many end-products that originate in modern chemical plants. In many of these plants **WILFLEY ACID PUMPS** are a vital factor in the production of ammonium nitrate—a basic ingredient. Wherever installed, highly efficient Wilfley pumps reduce pumping costs and increase production . . . operate without attention, delivering trouble-free performance on round-the-clock schedules. Available with pumping parts of the machinable alloys as well as plastic to meet all requirements. Individual engineering on every application. Write or wire for complete details.

**A. R. WILFLEY and SONS INC.** Denver, Colorado, U.S.A.
New York Office: 1775 Broadway, New York City

Photo shows Wilfley Acid Pumps handling **AMMONIUM NITRATE at HIGH HEADS**





Conveyor belt and storage bins at loading docks

# Crude Sulphur

**for Industrial Use**

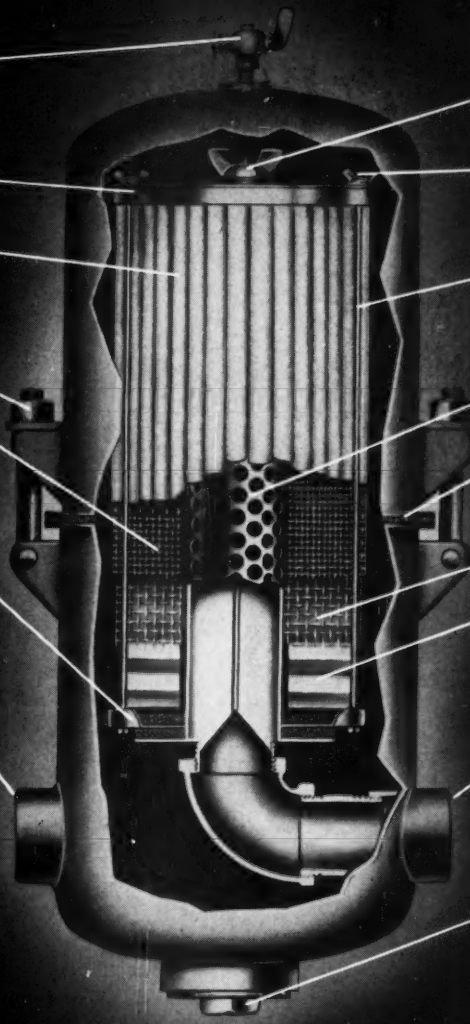
*from the properties of*

## Texas Gulf Sulphur Co.

**75 East 45th Street • New York 17, N. Y.**

*Producing Units*

- **NEWGULF, TEXAS**
- **MOSS BLUFF, TEXAS**
- **SPINDLETOP, TEXAS**
- **WORLAND, WYOMING**




Dollinger engineers welcome your filtration problems. Their complete engineering, design and laboratory facilities are at your disposal. Consult them; no obligation. Write today for new liquid filter folder D-1L.

REPRESENTATIVES IN PRINCIPAL CITIES

# STAYNEW LIQUID FILTERS

THE ANSWER TO YOUR LIQUID FILTRATION PROBLEMS

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

## DOLLINGER CORPORATION

4 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

DOW

You Can See Why

# SARAN LINED PIPE

## is your answer to downtime losses

***It's made of corrosion-resistant saran pipe swaged right inside rigid steel pipe . . . two pipes in one for longest-lasting performance.***

Here's really trouble-free piping . . . saran lined pipe, fittings and valves! This modern piping has a durable inner lining that eliminates shutdowns due to corrosion . . . forms tight-fitting joints that prevent leakage. Saran lined pipe, fittings and valves won't burst under working pressures up to 150 psi . . . and saran lined cast steel fittings are available for even higher pressures. Every single piece of saran lined pipe, fittings and valves is carefully spark-tested by hand to be sure there are no pinpoint holidays or cracks in the lining.

Installation costs are low with saran lined pipe, fittings and valves, too. They can be cut and threaded in the field with modified pipe-fitter's tools. And because they're rigid, few supporting members are needed.

If your operation requires the conveying of acids, alkalies, solvents and other corrosive liquids, be sure to investigate saran lined pipe, fittings and valves today. For further information, write the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, **Dept. SP-529A-2.**

RELATED SARAN PRODUCTS—Saran rubber tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

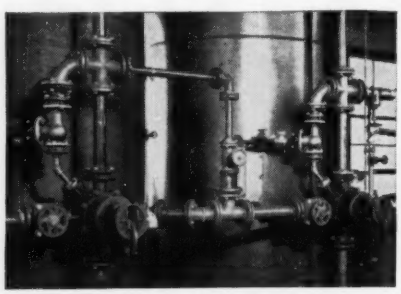
**SOME OF THE MANY INSTALLATIONS USING**

**SARAN LINED**

**STEEL PIPE**

*Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan*

Hydrochloric acid has been conveyed in this installation for well over seven years. Service has been eminently satisfactory.



Saran lined pipe is used here in an automatic water de-ionizer. This installation has also had a long record of uninterrupted service.

*you can depend on DOW PLASTICS* DOW

# YOU CAN CLEAN THIS STRAINER

## without interrupting production or contaminating the product

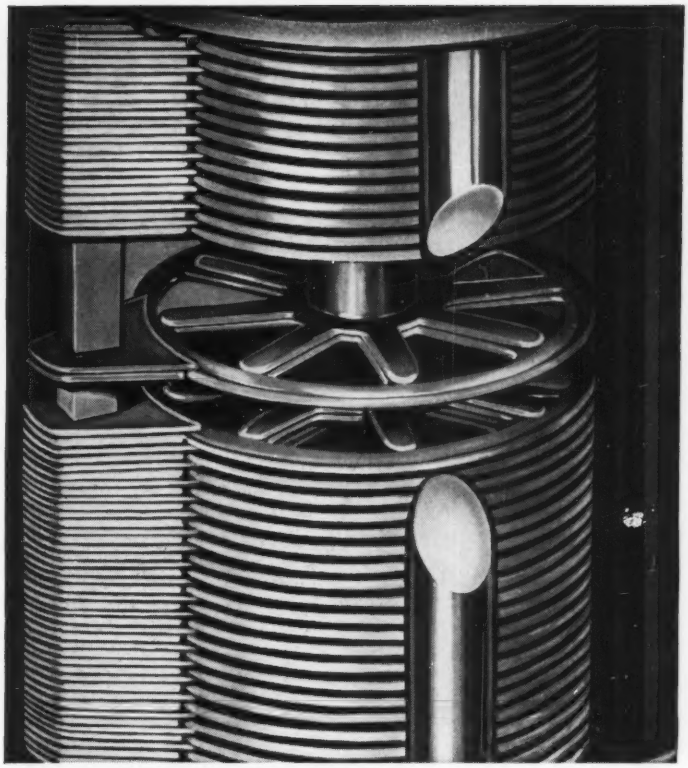
Here's *positive* and 100%-*continuous* fluid cleaning.

Cuno AUTO-KLEAN Strainer is the *only* fluid cleaner on the market that works uninterruptedly. It's continuously-cleanable without stopping flow and without dismantling. An occasional turn of a handle—while in operation—combs out dirt accumulations. This can also be done *automatically*.

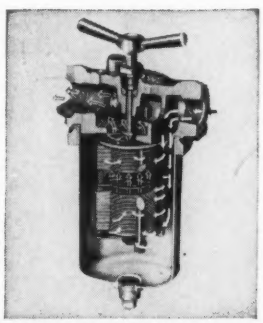
Thus—no loss of production, no chance of contaminating the product from exposure during element cleaning or replacement.

There's nothing to wear out and need replacement. All-metal Cuno AUTO-KLEAN Strainer will last as long as the equipment on which it is installed.

Models available for straining from .0035 to .062 in., a wide range of fluids, viscosities up to and above 300,000 SSU. Sizes to handle from a few to more than 4000 gpm. Send coupon for specific information about *your* fluid-straining problems.



**NON-STOP CLEANING** Turning metal discs past cleaner blades (periodically by hand or continually by motor or other automatic means) "combs out" all solids—even when imbedded in strainer element—without interrupting flow.



**CUNO AUTO-KLEAN** Strainer is *guaranteed* to remove all particles larger than specified.

CUNO

**COMPLETE LINE**

*Fluid Conditioning*

**Removes More Sizes of Solids from More Types of Fluids**

MICRONIC (Micro-Klean) • DISC-TYPE (Auto-Klean)
WIRE-WOUND (Flo-Klean)

**Find Out How AUTO-KLEAN Can Cut Your Fluid-Cleaning Costs . . . Mail This Coupon**

- ☐ Acids
- ☐ Air
- ☐ Alkali
- ☐ Boiler Feed
- ☐ Casein
- ☐ Cleaning Solutions
- ☐ Coatings
- ☐ Compressed Air
- ☐ Coolants
- ☐ Cutting Oils
- ☐ Dip Tank Systems
- ☐ Enamel
- ☐ Engine Fuel
- ☐ Engine Lubricating Oil
- ☐ Fuel Oil
- ☐ Fuel Tar
- ☐ Gases
- ☐ Gasoline
- ☐ Grease
- ☐ Grinder Coolant
- ☐ Hydraulic Oils
- ☐ Japan
- ☐ Lacquer
- ☐ Lubricating Oil
- ☐ Machine Tool Cutting Oil
- ☐ Machine Tool Hydraulic Oil
- ☐ Nitrocellulose Solutions
- ☐ Oils
- ☐ Paint
- ☐ Pyroxylin
- ☐ Quenching Oil
- ☐ Resins
- ☐ Rust Proofing Compounds
- ☐ Sizing
- ☐ Solvents
- ☐ Spray Systems
- ☐ Tar
- ☐ Test Stand Lubricating Oil
- ☐ Varnish
- ☐ Washing Compounds
- ☐ Water
- ☐ Wax

**OTHERS**_____

Cuno Engineering Corporation
3-12 South Vine Street, Meriden, Conn.

Please send me a free copy of your AUTO-KLEAN bulletin. I am especially interested in the services checked.

Name.....Title.....

Company.....

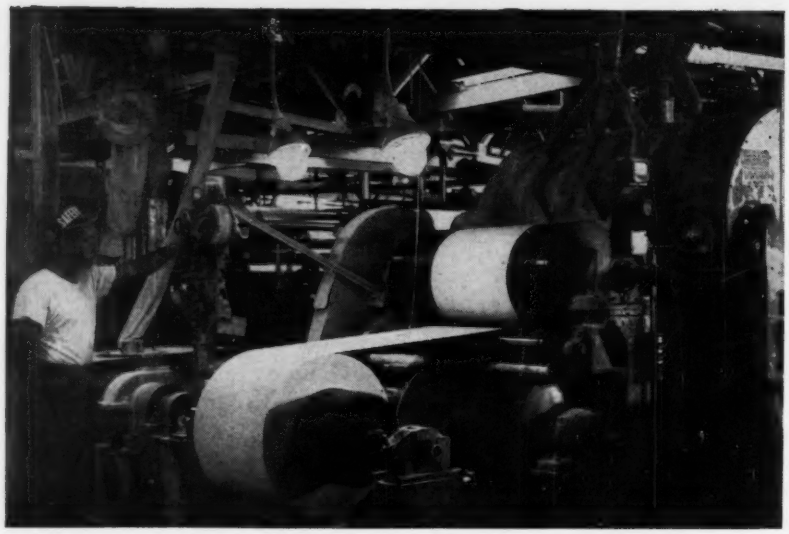
Address.....

City.....State.....

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

# DUST and FUME topics

WHEELABRATOR CORPORATION Mishawaka, Indiana

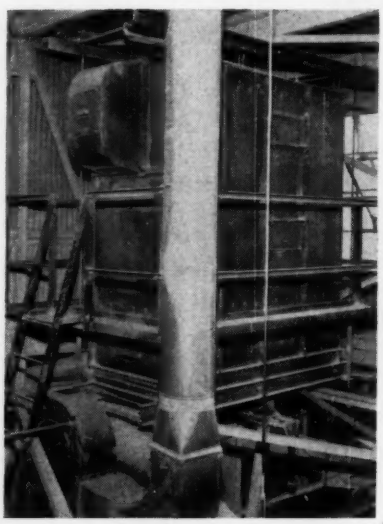


## Cornstarch Recovery Pays for Complete Dust Control

Installed primarily to improve housekeeping by controlling the dust created by cornstarch used to dry coated paper, a Wheelabrator Dustube Dust Collector recovered enough of the cornstarch to pay for the entire investment within three months' time.

Since then this midwestern paper processor has installed two similar collectors to ventilate other dust creating equipment. Savings effected by product recovery with these three cloth tube collectors have amounted to $45,000 annually.

Other benefits provided are better working conditions and elimination of fire and explosion hazards through the virtually 100% collection efficiency of the three Wheelabrator Collectors.



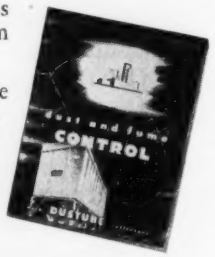
## New Dust Control Principle Provides "Ultra-Filtration"

Wheelabrator cloth tube type collectors, with an inexpensive filter aid on the filtering surface of the cloth, give collection efficiencies of virtually 100% of atmospheric dust, including extremely fine micron sizes.

Ultra filtration with Wheelabrator Collectors is already paying dividends in sewage disposal plants, power plants, greenhouses, etc. . . . where "clean" air is a necessity. Write for complete details.

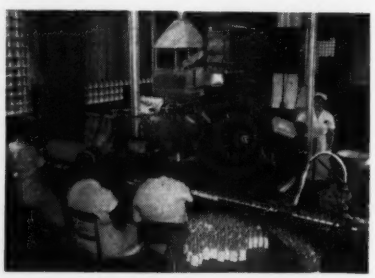
## How to Save Money in the Control of Chemical Dust

Dust created in the manufacturing and processing of chemicals can be recovered at a profit with virtually 100% efficiency in a Wheelabrator Collector. In addition, worker efficiency is improved through better working conditions and maintenance costs are less because dust is kept away from machinery.




Get the complete story on Wheelabrator Dustube dust and fume control. Write today for Catalog No. 372C.

## How Dust Free Can a Chemical Plant Be?



Packaging operations in this pharmaceutical plant are dust free through Wheelabrator Dust Control.

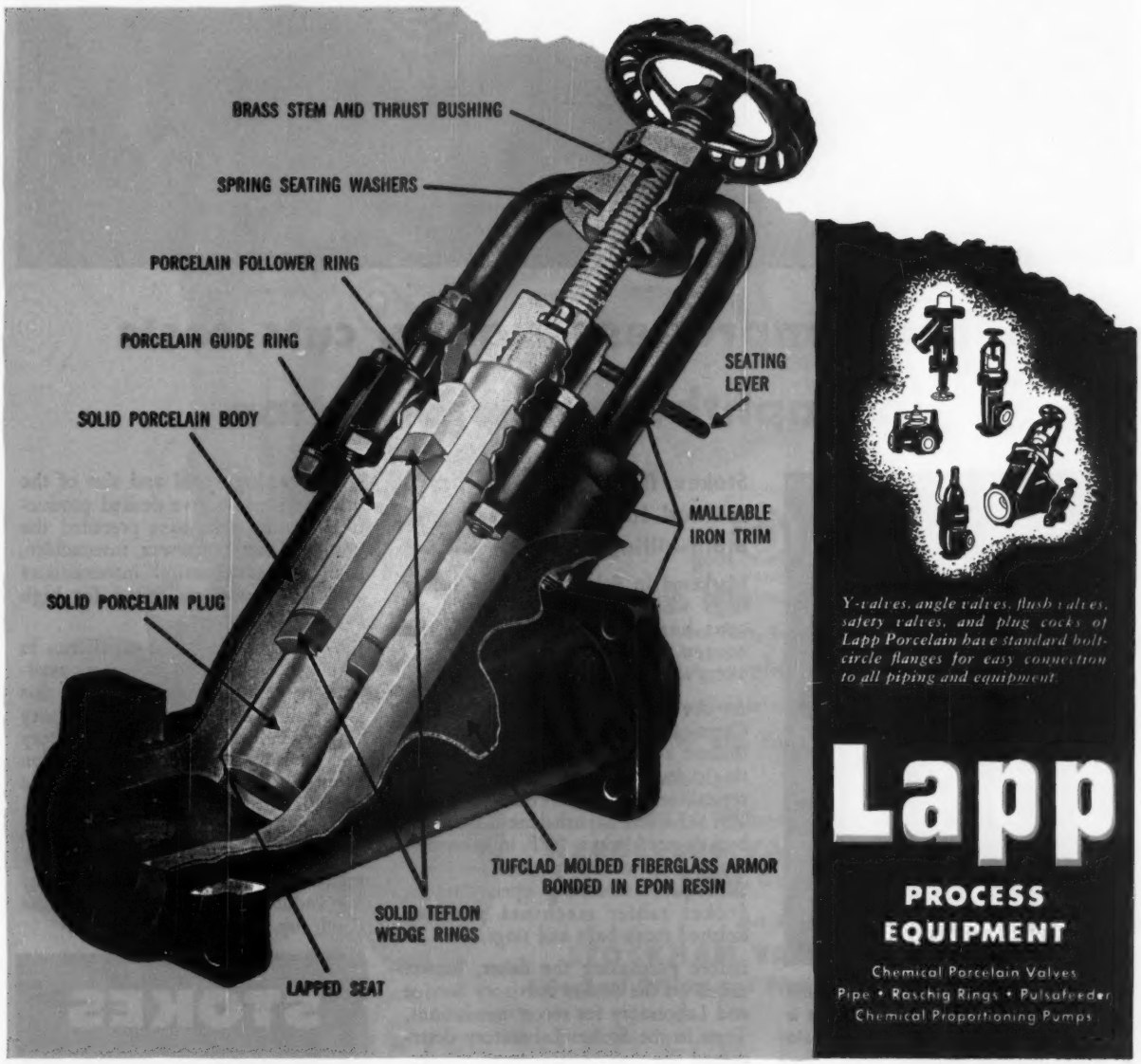
Wheelabrator cloth tube-type Collectors capture dust at the source before it has a chance to permeate the atmosphere. Any dry dust, regardless of particle size or concentration, can be handled. Virtually 100% efficiency is thus assured.

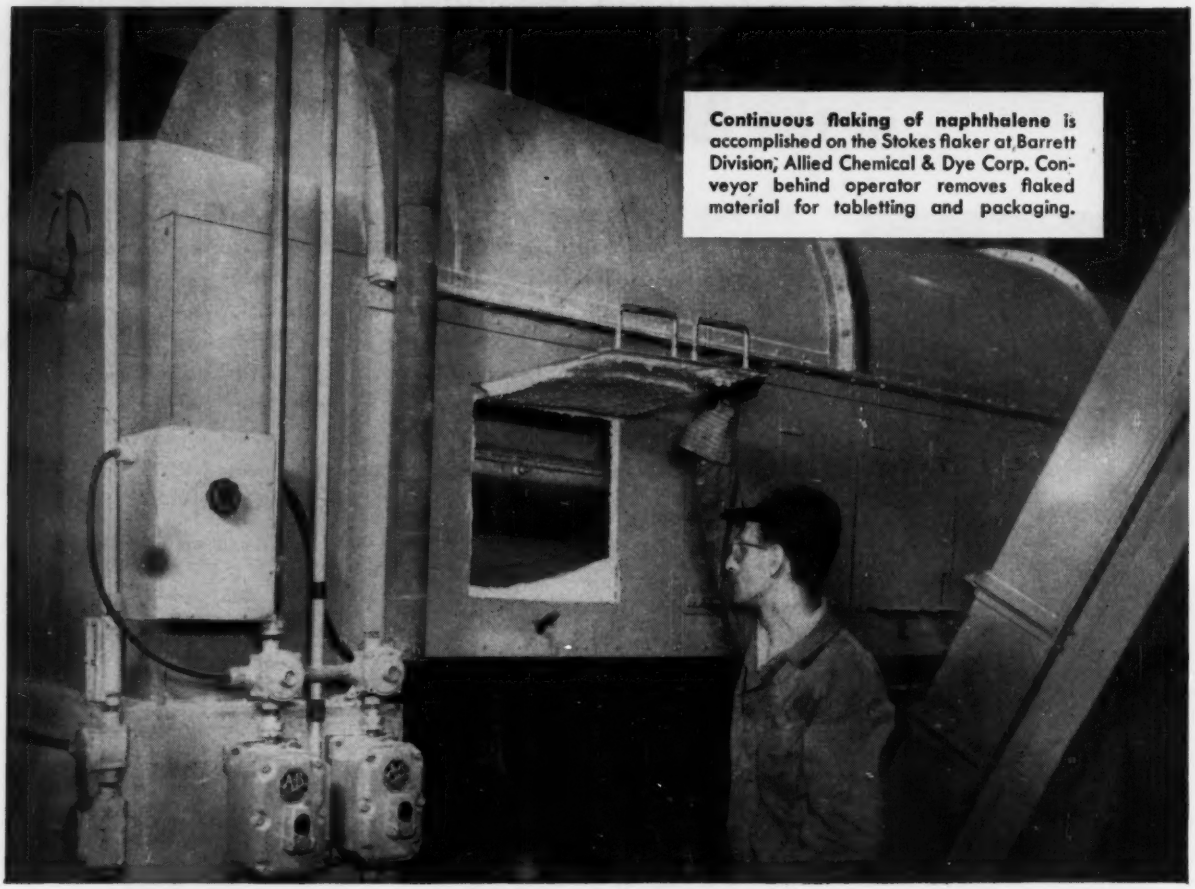
**WHEELABRATOR**
CORPORATION
(Formerly American Wheelabrator & Equipment Corp.)
347 S. Byrkit Street, Mishawaka, Indiana

# Precision Grinding of Solid Porcelain in the Lapp Valve

The high firing temperature, which assures complete vitrification and zero porosity of Lapp Porcelain, also makes impossible the maintaining of close dimensional tolerances. Necessary tolerances are achieved, however—in regular production ±.001"—by machine grinding with silicon carbide wheels. In the Lapp Valve, the entire stuffing box chamber, seating area, plug, guide and follower rings are finish ground, for precision assembly and complete interchangeability of parts. In addition, each porcelain plug is individually lapped and polished into its seat integral in the valve body. (No separable seating parts.) Each such valve seal is tested to 150 psi hydrostatic pressure before the valve is shipped.

*Write for bulletin with complete description, characteristics, and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 421 Wendell St., LeRoy, New York.*


BRASS STEM AND THRUST BUSHING
SPRING SEATING WASHERS
PORCELAIN FOLLOWER RING
PORCELAIN GUIDE RING
SOLID PORCELAIN BODY
SOLID PORCELAIN PLUG
SEATING LEVER
MALLEABLE IRON TRIM
TUFCLAD MOLDED FIBERGLASS ARMOR BONDED IN EPON RESIN
SOLID TEFLON WEDGE RINGS
LAPPED SEAT
Y-valves, angle valves, flush valves, safety valves, and plug cocks of Lapp Porcelain have standard bolt-circle flanges for easy connection to all piping and equipment.
Lapp
PROCESS EQUIPMENT
Chemical Porcelain Valves
Pipe • Raschig Rings • Pulsafeeder
Chemical Proportioning Pumps



**Continuous flaking of naphthalene** is accomplished on the Stokes flaker at Barrett Division, Allied Chemical & Dye Corp. Conveyor behind operator removes flaked material for tabletting and packaging.

# Barrett improves quality, cuts costs in naphthalene production

**Purity is higher, costs lower with continuous flaking process. Flaked naphthalene is compressed into balls or rings, with the aid of Stokes tabletting machines.**

## Stokes flaker replaces batch method in the processing of moth-killing chemical

Marketed in flakes, balls and handy rings which slip over the hook of coat-hangers, naphthalene is the housewife's friend—and the moth's worst enemy.

At the Barrett Division of Allied Chemical & Dye Corp., molten naphthalene at 194°F. is fed to a Stokes single drum flaker where the material crystallizes on the revolving drum. The solidified naphthalene is removed by a doctor blade at 72°F. in quantities ranging up to 1500 pounds per hour. Subsequent tabletting operations on Stokes tablet machines produce finished moth balls and rings.

Before purchasing the flaker, Barrett called on the Stokes Advisory Service and Laboratory for recommendations. Tests in the Stokes Laboratory determined the appropriate drum temperature, rotating speed and size of the unit required to give desired production. Similar tests have preceded the design of flakers for wax, insecticides, resins, many chemical intermediates and other products suited for high capacity flaking.

Stokes makes its broad experience in all phases of chemical processing available to manufacturers through this well-staffed Laboratory and Advisory Service. Full details of this laboratory and advisory service for the solution of production problems are covered in Bulletin 640.

Send for this booklet as well as an informative brochure on Stokes equipment for the Chemical & Processing Industries. F. J. Stokes Machine Company, Philadelphia 20, Pa.

**STOKES**

# STEAM-JACKETED

## for handling VISCOUS LIQUIDS

An installation of Wedgeplug Steam-Jacketed Valves in a large plant handling sulphur at a temperature of 270° F.

**WEDGEPLUG**
NON-LUBRICATED
STEEL PLUG VALVES

**For Special Services—handling products that will harden or congeal at ordinary temperatures, such as: asphalt, pitch, petroleum residue, tar, resins, vegetable and animal fats, soap, sulphur, etc.—Wedgeplug Valves can be supplied Steam-Jacketed. Positive action of the valve is assured. Wrench-Operated or Gear-Operated; also can be furnished equipped for Remote Control.**

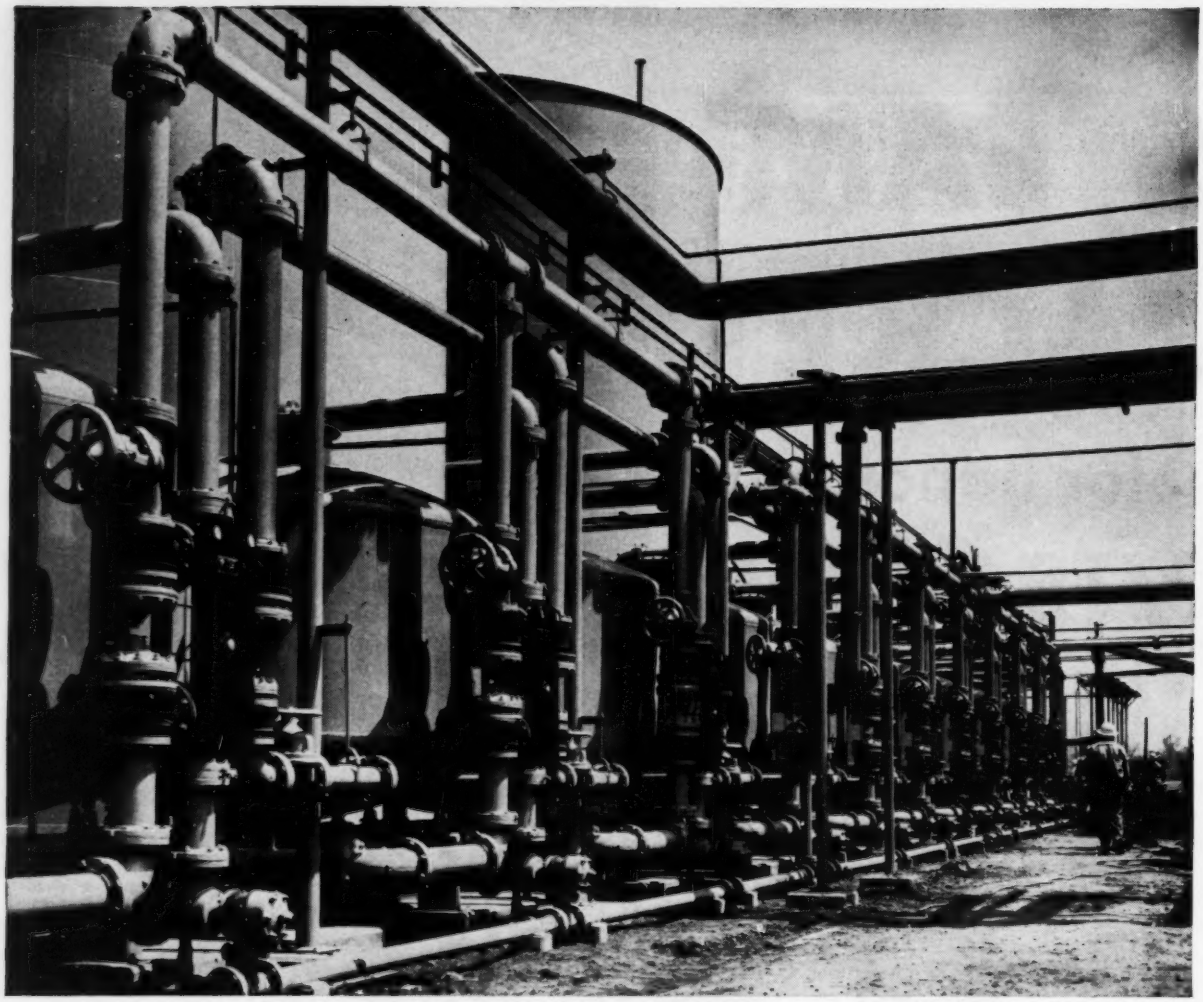
*Write for Wedgeplug Catalog No. 55-1-W*

**WEDGEPLUG VALVE COMPANY, INC.**
**New Orleans 25, La.**

*An Affiliate of*

**STOCKHAM VALVES & FITTINGS**
**General Offices and Plant • Birmingham 2, Ala.**

## DESIGN ELIMINATES NEED FOR LUBRICATION



# TITANIUM... your solution to corrosion problems

Titanium can eliminate many of your most serious corrosion problems, for it is exceptionally resistant to most forms of corrosive attack. Titanium, for example, is almost entirely inert to the chloride ion. Corrosion rates from nil to 0.15 mils per year are reported for titanium immersed in hot and boiling solutions of cupric and ferric chloride, and sodium and calcium hypochlorite.

But titanium's remarkable qualities do not stop there. It is as strong as steel, but 44% lighter . . . and can be worked by standard shop practice.

In valve trim, drums, heat exchangers, condensers, for example, titanium pays its way in less idle equipment time . . . lower replacement costs . . . less product contamination.

REM-CRU's engineers will be glad to help you make the best use of this unique metal in your plant. And it can be done *fast*, for REM-CRU's expanded facilities mean prompt delivery of REM-CRU titanium in the forms and grades you need.

***To keep abreast of the latest developments on this vital metal, write to Dept.C12 for the Rem-Cru Review—a free periodical presenting the latest technical data on titanium alloys.***

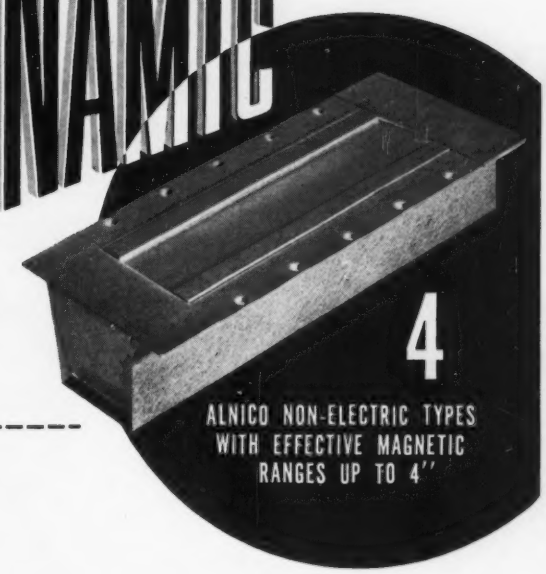
**REM-CRU TITANIUM**

**REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA**

PRESENTING THE
ALL-NEW

Dings

# DYNAMIC




## PERMA-PLATE MAGNETS
### FOR EFFICIENT—LOW COST TRAMP IRON REMOVAL

DINGS—The world's largest exclusive builder of magnetic separation equipment—now brings to all industry an entirely new concept of efficient, low cost tramp iron removal . . . through the completely new line of non-electric Alnico Perma-Plate Magnets, incorporating the *DYNAMIC* principle of magnetic separation.

Designed and built to remove tramp iron from moving material carried in chutes, ducts, on conveyor belts and slides, these new powerful, guaranteed permanent Alnico V magnets are used to separate iron from grain, feed, chemicals, foodstuffs, plastics, fertilizers, minerals, textile fibers, liquids and wet and dry solids of many kinds. Perma-Plates are also needed wherever tramp iron or iron of abrasion can damage processing equipment, create fire hazards, or contaminate product purity.

*Clip the coupon for full details.*

The new Dings DYNAMIC Perma-Plates are plate type permanent non-electric Alnico magnets designed to attract moving iron. This proven design is the result of hundreds of extensive *dynamic* tests . . . *not* based on static tests.

As shown by illustrations (1) and (2), a *pull test* is a static test having negligible bearing on the magnet's ability to attract rapidly moving iron. It is not *dynamic.*

Illustration (3) shows a *lift test,* again a static test having negligible bearing on the magnet's ability to attract moving iron. It is not *dynamic.*

Illustration (4) shows a *chute test* . . . the only *true* test of a plate magnet's ability to attract rapidly moving iron. *This is the DYNAMIC principle of operation of the new Dings Perma-Plate Magnets.*

**DINGS MAGNETIC SEPARATOR CO.**
4730 WEST ELECTRIC AVENUE
MILWAUKEE 46, WISCONSIN

The new Dings Perma-Plates are available in 4 basic types, offering effective magnetic ranges from 2½" through 4". Each type is available in 35 standard sizes from 4" through 72" wide.

Complete details of these versatile DYNAMIC Magnets are given in the new Catalog 1205-D, just off the press. Mail coupon for your copy.

Dings

*MAGNETIC SEPARATION LEADERS FOR OVER FIFTY YEARS*

***MAIL THIS COUPON TODAY***

DINGS MAGNETIC SEPARATOR CO.
4730 W. Electric Ave., Milwaukee 46, Wis.

Send copy of new Catalog 1205-D to:

Name_____

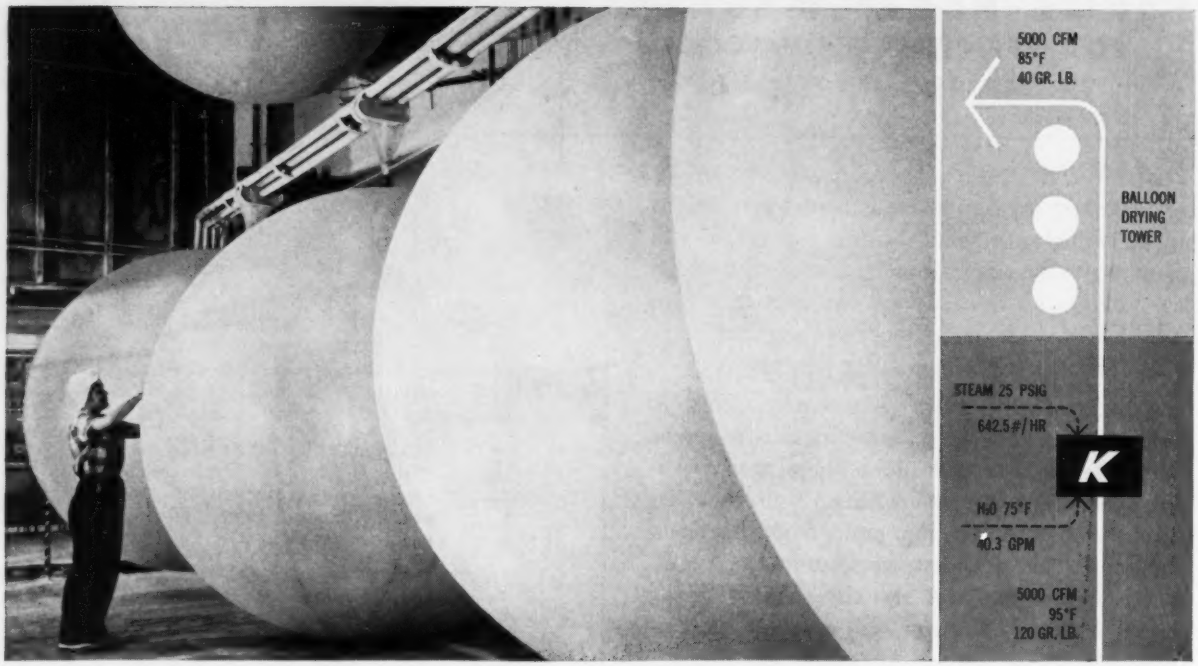
Company_____

Address_____

City_____ Zone____ State_____

PP155

# Dry air saves balloon-maker $2500/yr.




Low-temperature dry air saves the Dewey and Almy Chemical Company $2500 or more a year in operating costs. Kathabar humidity conditioning delivers this air for drying weather balloons (see flow diagram) using only 75°F city water and low pressure steam. Dewpoint of the air is reduced from 72.5°F to 43°F without refrigeration!

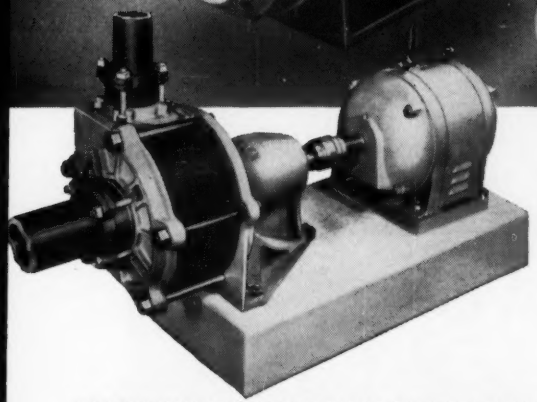
Compared with standard refrigeration for the same operation, the Kathabar system saves 81¢ an hour in water, steam, and electricity requirements—operating savings of over $6 per 8-hour day! In addition, the first cost of Kathabar equipment is lower, operation and maintenance are simpler.

If your operations require low-temperature drying, it will pay you to investigate the many economies of Kathabar humidity conditioning.

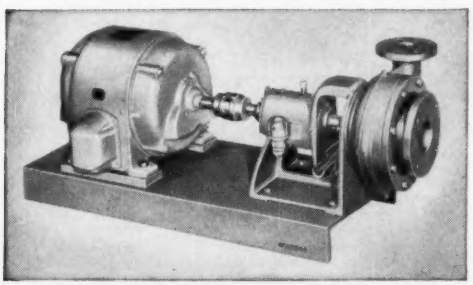
**write for the complete Dewey & Almy story today**

Kathabar®
HUMIDITY CONDITIONING

**SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO**



**FAMOUS KARBATE* NON-METALLIC CHEMICAL PUMP,** made of impervious graphite by National Carbon Company. Now you'll be able to buy this pump from Worthington. Karbate pumps include motor-mounted (close-coupled) and frame-mounted units with capacities ranging from 5 to 1500 gpm at heads to 110 feet at conventional motor speeds.



**WORTHITE TYPE CNG CENTRIFUGAL CHEMICAL PUMP.** Super-stainless Worthite provides best all-round metallic corrosion resistance in a standard pump. Manufactured in 27 standard sizes, it assures you of complete hydraulic coverage up to heads of 235 feet and capacities of 2500 gallons per minute. Worthite type CNG pumps are available with standard stuffing boxes, with Teflon seal cage arranged for independent cooling liquid, or with external mechanical seal.

# Now Worthington offers you the widest standard corrosion-resistant pump line

## as Karbate* impervious graphite supplements Worthite

Worthington Corporation is now marketing Karbate brand centrifugal pumps, manufactured by National Carbon Company, a Division of Union Carbide and Carbon Corporation, in addition to our Worthite centrifugal chemical pumps.

In Karbate pumps, parts in contact with the liquid pumped are made of impervious graphite, making the pumps applicable for many corrosive services where conventional metals or alloys are unsuitable.

Worthite pumps already form the broadest line of metallic centrifugal pumps in the industry. This coverage is now completed by the addition of the non-metallic Karbate Brand Impervious Graphite Pumps. You'll find Worthite and Karbate pumps your best bet for virtually 100 percent of corrosive applications.

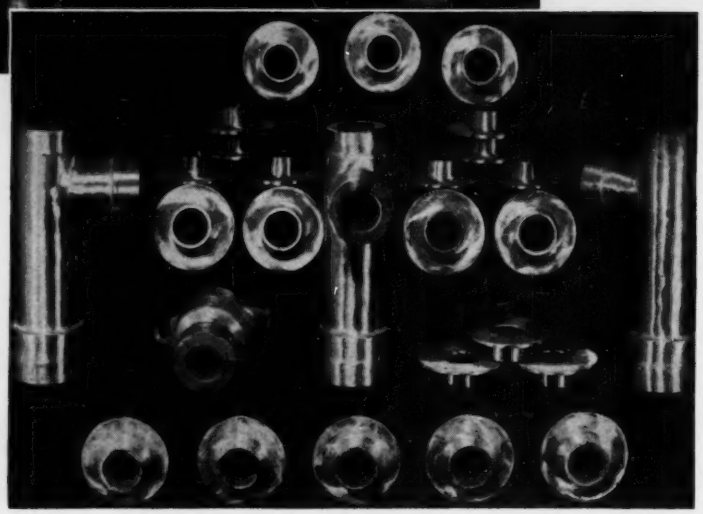
Worthite is a high-nickel, high-chromium, molybdenum alloy steel, with 0.07 percent maximum carbon content. It is stainless and its stabilizing elements tend to prevent intergranular corrosion.

Write today for copies of bulletins W-350-B14A and W-350-B18 describing in detail Worthite and Karbate centrifugal chemical pumps. Worthington Corporation, Harrison, New Jersey. C.5.1A

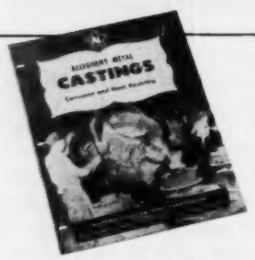
*Reg. Trademark of Union Carbide and Carbon Corporation.*

# WORTHINGTON

**BE SURE TO SEE THIS NEW PUMP**
**AT BOOTH NUMBER 848, CHEMICAL SHOW**
**PHILADELPHIA, DEC. 5–9, 1955**



# This is the mark that means clean, sound Stainless Castings all the time




**Write for your copy: "ALLEGHENY METAL CASTINGS"**

32 pages of valuable and complete data on stainless castings: analyses, properties, technical data on handling and heat treatment, typical applications, how to order, etc.

**ADDRESS DEPT. CE-72**

Every stainless casting produced by our Buffalo Foundry carries the familiar "AL Star" trademark, cast into the steel. That means it's *Allegheny Metal,* the time-tested stainless steel—a pioneer that has successfully answered thousands of difficult corrosion and heat resisting problems.

It not only means experience in stainless casting applications, but in maintained high quality, too. The A-L Buffalo Foundry is a pioneer in both the vertical-centrifugal and static methods of casting stainless steel. You can depend upon Allegheny Metal Stainless Castings to be strong, clean-surfaced, sound-structured and easy-machining . . . fully in accord with the service conditions and with your requirements for delivery.

Let our stainless foundry specialists quote on *your* problem jobs—any shape casting or any size, up to thousands of pounds. ● *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

W&D 5007 B

**For Stainless Steel in ALL Forms—call**

# Allegheny Ludlum

**Warehouse stocks carried by all Ryerson Steel plants**

AL STAINLESS STEEL ®

# Vinyl Acetate Monomer

*from*

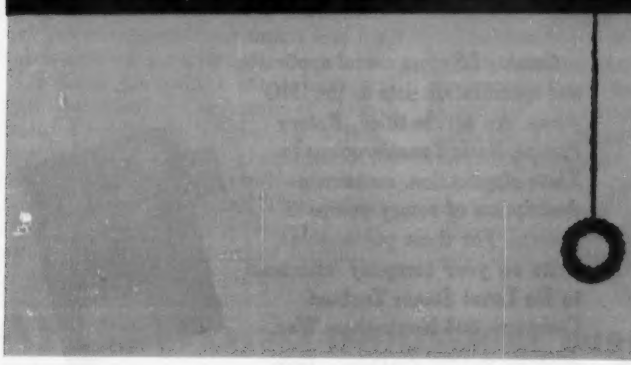
# Air Reduction Chemical Company

**NEW CALVERT CITY, KENTUCKY, PLANT**

*on stream*

# Early in 1956

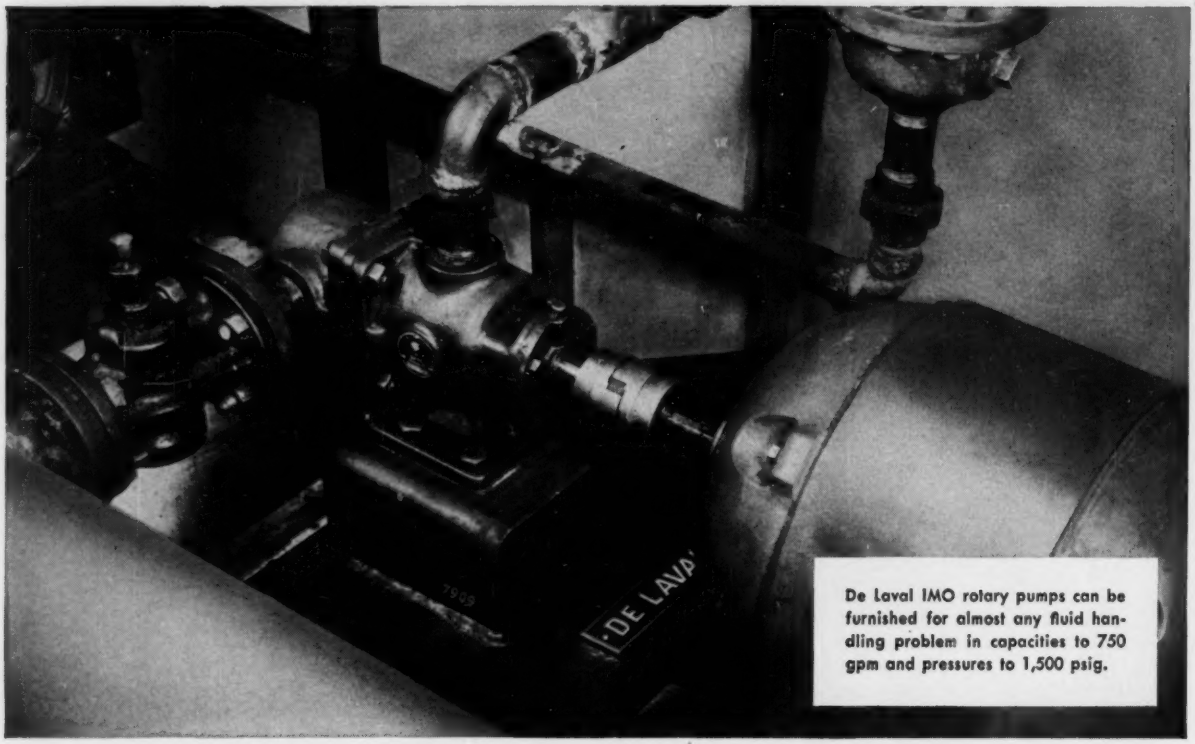
AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .



AIRCO

**AIR REDUCTION CHEMICAL COMPANY**

*A Division of Air Reduction Company, Incorporated*
*General Offices: 60 East 42nd Street, New York 17, N. Y.*
*Represented Internationally by Airco Company International*




De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 1,500 psig.

# What to Look for in a Rotary Screw Type Pump

*By* W. J. MONCON, *Assistant Chief Engineer*
*De Laval Steam Turbine Company*

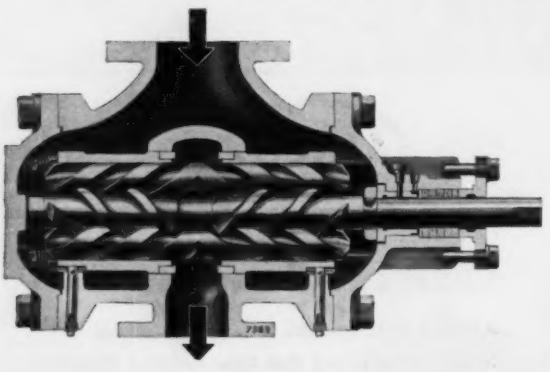
A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.

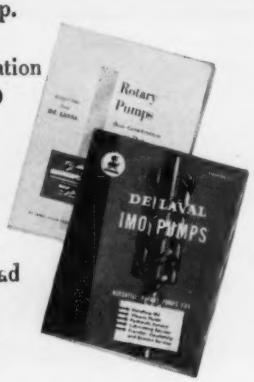
One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

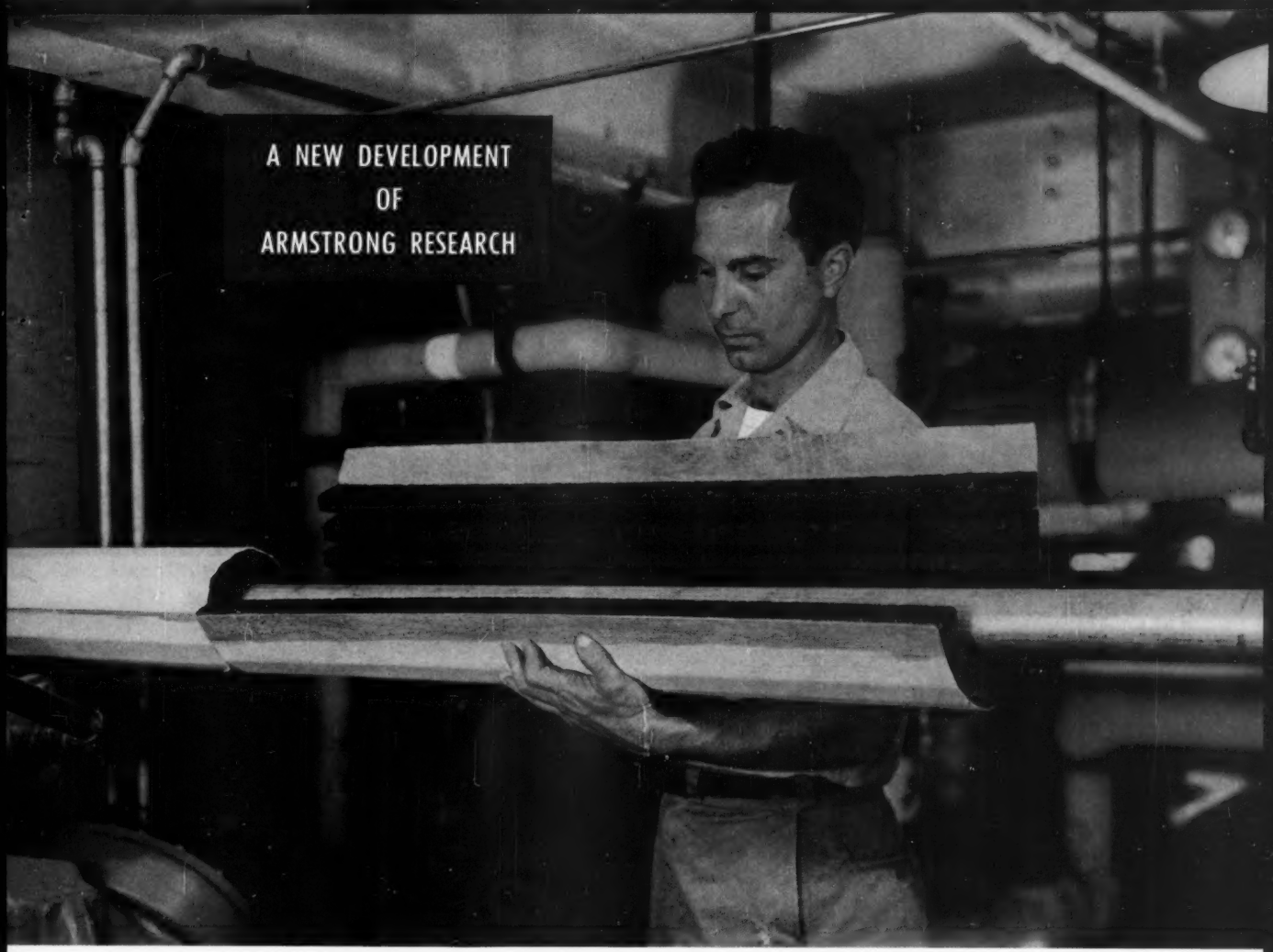
A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.



De Laval IMO Series A322A, a positive displacement, rotary screw type pump, can handle capacities to 750 gpm and pressures to 150 psig.

*Catalog LS* gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application*, contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 803 Nottingham Way, Trenton 2, New Jersey. DL-301






# LT Cork Coverings . . . *low-cost, easy-to-apply insulations for low-temperature lines*

This complete new line of economical cork pipe covering is designed to prevent condensation on lines operating at temperatures to 30° below zero. Available in three types—LT-Thirty, LT-Zero, and LT-Minus Thirty—these coverings offer the same high insulating efficiencies and long life as molded cork coverings, yet cost much less for materials and installation.

LT Cork Coverings are fabricated from precision-cut sections of Armstrong Corkboard bonded to a fire-resistant, asbestos and aluminum foil jacket. The aluminum foil acts as a built-in vapor barrier. The white jacket presents a trim appearance that usually requires no further finishing.

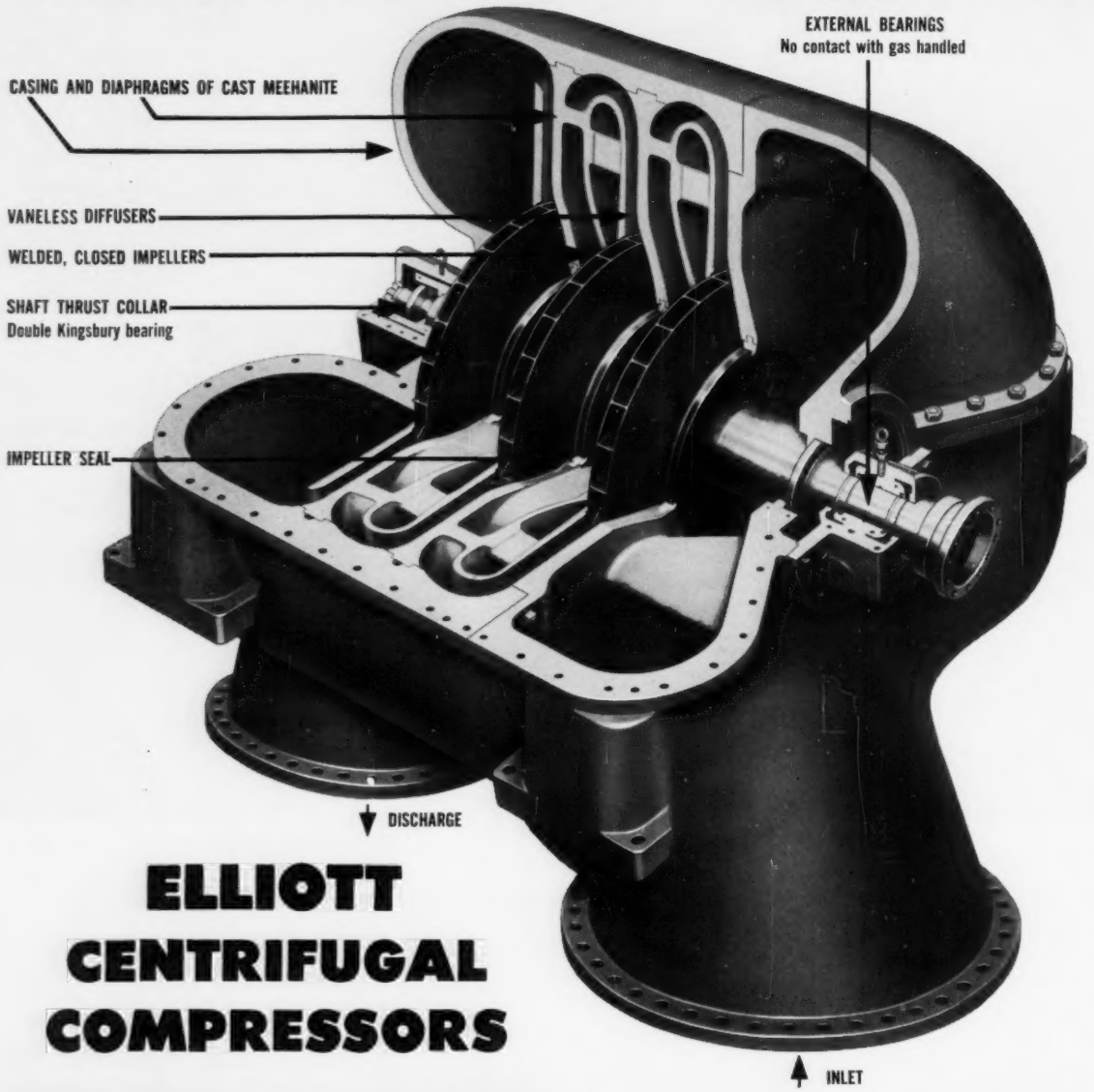
Installation of LT Cork Coverings is fast and easy. Simply apply Armstrong 520 Adhesive to a special overlap on the covering, fit the covering tightly around the pipe, and press the lap firmly in place. Butt joints are sealed quickly with a self-adhering white vapor-barrier tape.

The development of LT Cork Coverings is another example of how Armstrong continues to work to improve industrial insulation materials and methods. For descriptive booklets on the entire Armstrong line of industrial insulations and Complete Contract Service, call your nearest Armstrong office or write Armstrong Cork Company, 2010 Stratton St., Lancaster, Pa.

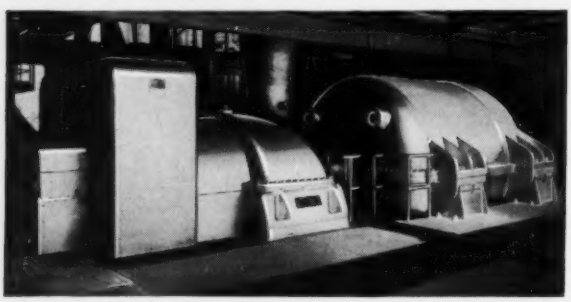
**LT-Thirty Cork Covering** prevents sweating under normal conditions at line temperatures of 30° F. or above. LT-Zero is suitable at temperatures down to 0° F.; LT-Minus Thirty at temperatures to −30° F.

**Armstrong INDUSTRIAL INSULATIONS**

# Pointing the way to non-stop performance




## ELLIOTT CENTRIFUGAL COMPRESSORS



**ONE OF THE LARGEST CENTRIFUGAL COMPRESSORS IN SERVICE TODAY**
This Elliott compressor, installed in a southwest refinery, handles 135,500 inlet cfm of air at 22.0 psig discharge pressure.

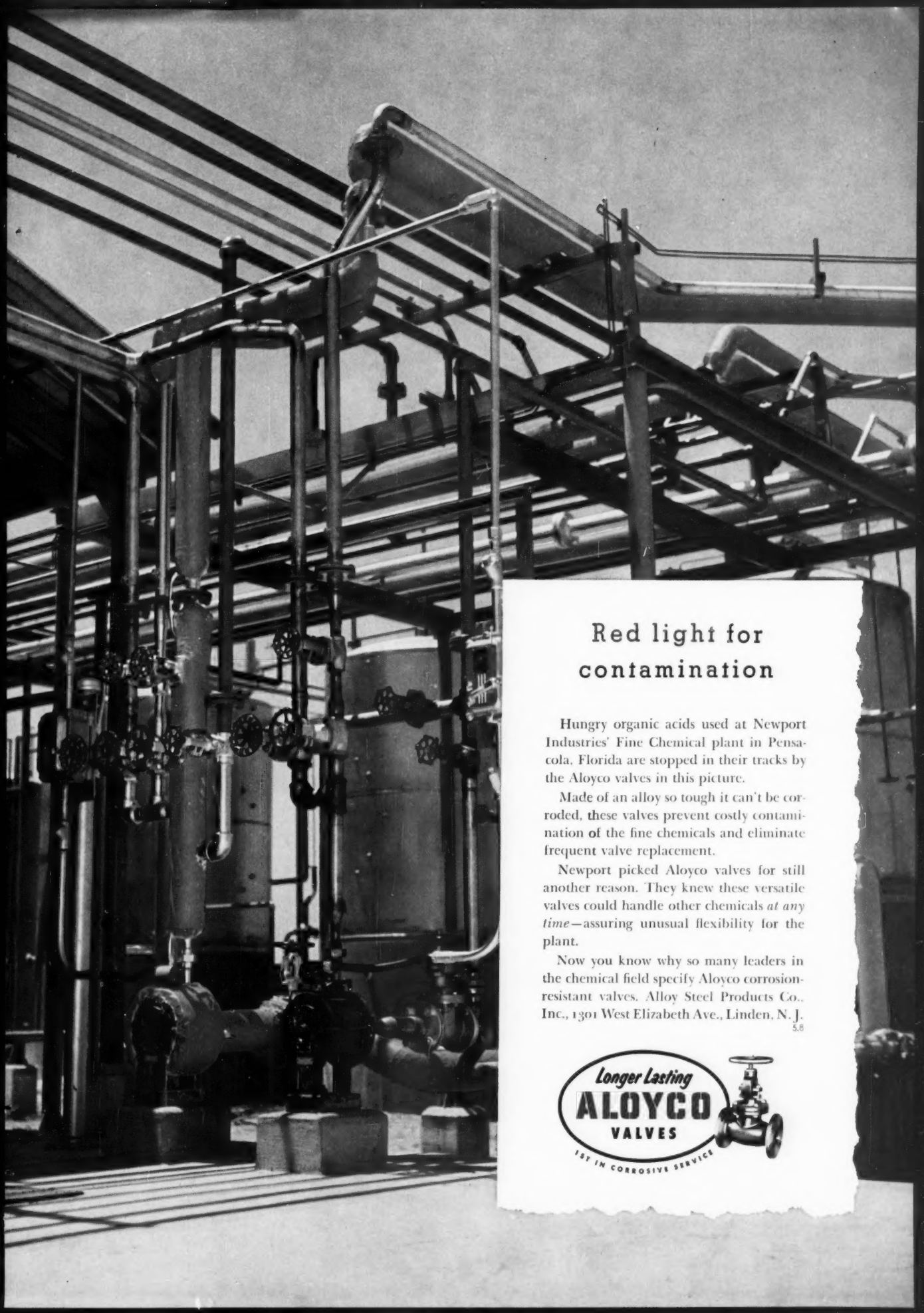
Take a good, close look at this Elliott Multistage Centrifugal Compressor. Note its simplicity and ruggedness of design and construction. It's easy to see why these compressors have been setting non-stop service records in refineries. They're built for the "long run."

Elliott Centrifugal Compressors are available in both single and multistage types, for inlet capacities up to 175,000 cfm, and discharge pressures up to about 2000 psig. Drive may be turbine, gear-motor combination or direct-connected motor, all built by Elliott. For details write Elliott Company, Centrifugal Compressor Dept., Jeannette Pa.

**ELLIOTT Company**

P5-1A

TURBINE-GENERATORS · TURBINES · MOTORS · GENERATORS · DEAERATING HEATERS · EJECTORS · CONDENSERS · COMPRESSORS · TURBOCHARGERS · TUBE CLEANERS · STRAINERS



## Red light for contamination

Hungry organic acids used at Newport Industries' Fine Chemical plant in Pensacola, Florida are stopped in their tracks by the Aloyco valves in this picture.

Made of an alloy so tough it can't be corroded, these valves prevent costly contamination of the fine chemicals and eliminate frequent valve replacement.

Newport picked Aloyco valves for still another reason. They knew these versatile valves could handle other chemicals *at any time*—assuring unusual flexibility for the plant.

Now you know why so many leaders in the chemical field specify Aloyco corrosion-resistant valves. Alloy Steel Products Co., Inc., 1301 West Elizabeth Ave., Linden, N. J.

5.8

Longer Lasting
ALOYCO
VALVES
1ST IN CORROSIVE SERVICE

THE INDEX

TO THIS VOLUME HAS BE

EX

BEEN REMOVED

**THIS ENTIRE VESSEL** was radiographed. Built for use by Socony Mobil Oil Company, Incorporated, it was stress relieved in thirds, and the two joints were stress relieved locally. The unit contains 30 uniflex trays of 96" diameter. Overall weight: 152,000 lbs.

# Among the largest in use

## ...built by Newport News

**This Debutanizer** with a 110 feet 6 inches over-all length is typical of units that are readily built by Newport News . . .

In fact, Newport News can fabricate almost any type of pressure vessel or other heavy equipment used in the petroleum, chemical or other processing industries.

But at Newport News you'll find more than large productive capacity.

In vast fabricating shops, in huge machine shops, foundries and forging plants, Newport News craftsmen complete your order with specialized techniques. Plant methods . . . developed as a result of specializing for more than half a century . . . enable Newport News to provide money-saving answers to all sorts of heavy equipment problems.

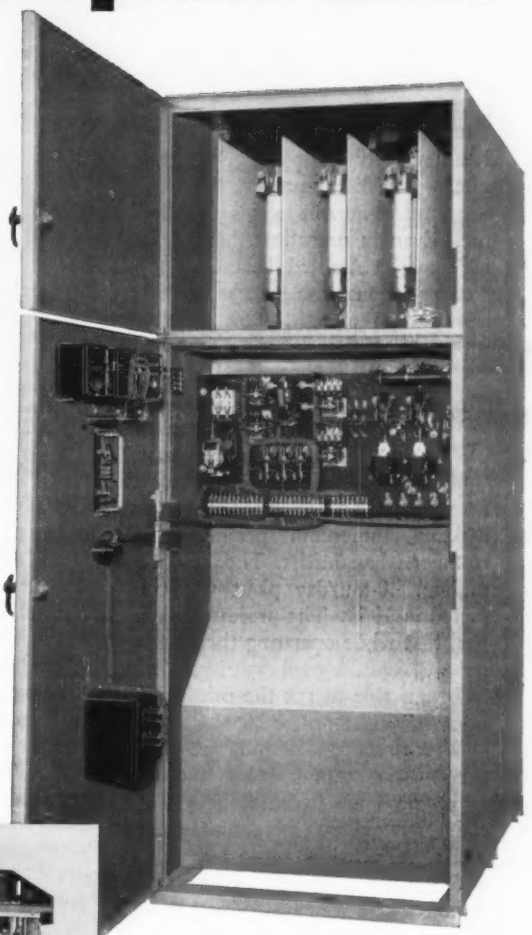
Newport News craftsmen handle the job exactly as you want it done . . . for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and Products"...it's yours for the asking.

**Engineers** — Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

**Newport News** Shipbuilding and Dry Dock Company
Newport News, Virginia

# Complete "Line-to-Load" MOTOR *Control and Protection* in ONE Compact Unit

**ALLIS-CHALMERS**
**Type H Starters**
**FOR 2300 TO 5000 VOLT MOTORS**



THE Allis-Chalmers Type H high voltage starter is a complete control unit. Everything needed for efficient motor control and positive protection is engineered into one easy-to-install cubicle.

Control functions, varying with specific job applications, include full or reduced-voltage starting, acceleration, speed control, reversing or non-reversing, and dynamic braking.

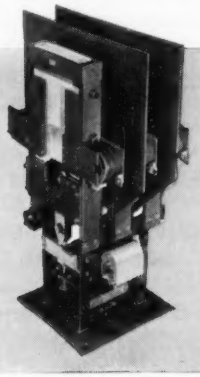
### A few of the many protective features

**Current-Limiting Fuses** clear short circuit in less than ½ cycle . . . long before short can damage contactor or motor.

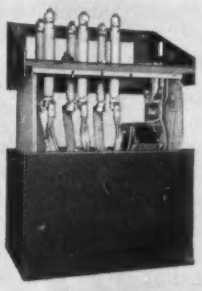
**Overload Thermal Relay** adjusts for ambient temperatures . . . trips only on motor overload. Allows use of maximum capacity.

**Time-Delay Undervoltage Relay** permits restarting if power is restored within its setting.

**Compartmented Enclosures** isolate high voltages. Dead front construction and electrical interlock on fuse compartment provide additional personnel protection.



**Choice of Air or Oil Contactors**



For complete information, see your Allis-Chalmers representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 14B6410B.

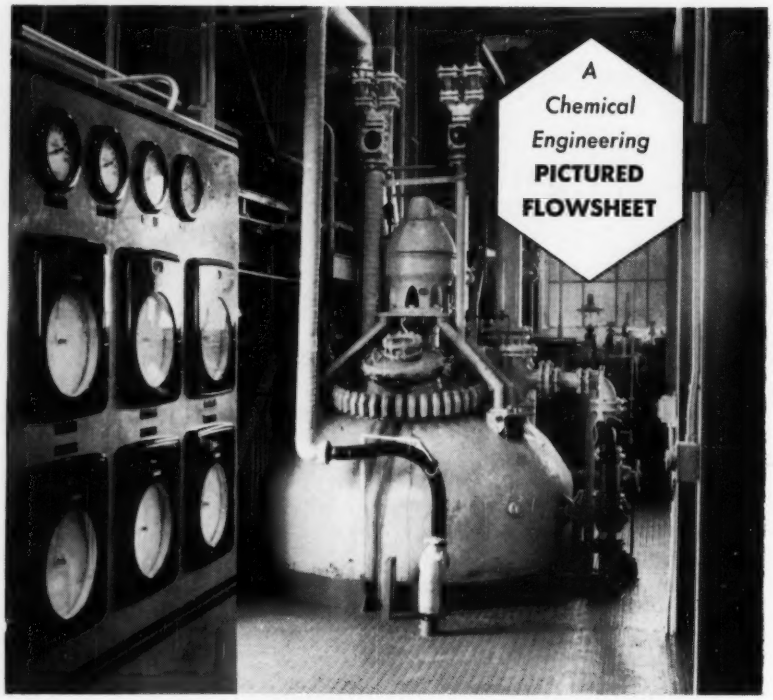
A-4580

**ALLIS-CHALMERS**

**Making a Hazardous Chemical:**

# Ammonium Perchlorate

**Need for smokeless rocket and jato propellant sparked demand; attention to equipment design, materials of construction and fireproofing solved process problems.**




**REACTOR at Western Electrochemical's 40-ton/day Henderson, Nev. plant.**

In the late '40s, development of a smokeless rocket propellant became a prime military necessity. During wartime, standard high-ash propellants, based primarily on potassium perchlorate, would disclose rocket sites, making them vulnerable to counter-battery fire. Even in peacetime, heavy-smoking jato (Jet Assisted Take Off) units create a serious problem when used on carrier-based aircraft. One solution: substitution of ammonium for potassium to eliminate the residual ash problem.

Wecco tackled the manufacturing problem in 1948 and after five years of work in a 4-ton/day pilot plant came up with the first practical process for making ammonium perchlorate in commercial quantities. The present $5 million, 40-ton/day plant was completed in 1953. The process works so well that while operating the plant at only 25% of designed capacity, Wecco has been able to cut the price to defense contractors some 18%.

► **How Reactor Works**—Heart of the process is a steam-jacketed reactor in which ammonia, hydrochloric acid and sodium perchlorate mix simultaneously and continuously.

Originally, Wecco believed ammonia and hydrochloric acid would have to be mixed separately to produce ammonium chloride, which could then be mixed with sodium perchlorate, producing salt and ammonium perchlorate. While the reactor was being designed and built, Wecco engineers also thought that heavy agitation might be required to keep the reacting mixture uniform and utilize the full volume of the reactor—either that or a series of small reactors would be necessary.

Actually, the final reactor is a simple one requiring moderate agitation. The successful design centers around the arrangement of dip-pipes used to introduce ammonia and hydrochloric acid into the reactor.

A Teflon dip-pipe introduces ammonia about 10 in. in from the glass-lined wall and about 2 ft. from the bottom.* Simultaneously, hydrochloric acid is introduced through a molded rubber pipe surrounding, but 10 in. shorter than the ammonia dip-pipe.

Originally, the ammonia pipe ended 10 in. inside the acid pipe, providing opportunity for the two reagents to react and form ammonium chloride, prior to contacting the sodium perchlorate. But surges in the last 10 in. of the acid pipe shook the reactor violently, causing breakdowns. Accordingly, the ammonia dip-pipe was lengthened, leading ammonia directly into the sodium perchlorate.

Wecco found it impossible to control the reactors manually, so the three feed streams are automatically proportioned, with a single valve controlling the sodium perchlorate flow. Rate of ammonia flow is controlled by a proportional controller fed from the sodium perchlorate controller, and the rate of flow for the hydrochloric acid is controlled by a proportional controller in which the ratio is set by a pH meter.

► **Materials of Construction**—During start-up of the plant, several fires broke out in the drying and packaging equipment. These fires occurred when the ammonium perchlorate crystals came in contact with copper tubing in the vibrating pan-dryer heat exchangers. When stainless steel was substituted for copper the fires ceased.

* Over-all dimensions of the reactor are 66x93 in. I.D., with a 0.03-in. glass lining over the entire inner surface.

► **Fireproofing Is Important**—Ammonium perchlorate is relatively unstable and highly flammable. It begins to decompose at about 400 F. And though this decomposition more often than not takes place quietly without breaking into flame, it does result in loss of product. To overcome the twin problems of fire hazard and product loss, the perchlorate is rapidly dried through the critical range of moisture content (between 0.02 and 0.5%).*

As a safety precaution, all units of the plant are hosed down daily. Furthermore, the drying and packaging operations are carried out in identical, three-story buildings housing the flash drying, tunnel drying and packaging operations in individual fireproof units with explosion release walls. All equipment, of course, is of explosion-proof design.

► **How the Process Works**—On the average, about 8200 lb. of 56% Na perchlorate, 3900 lb. of 35% hydrochloric acid and 640 lb. of anhydrous ammonia are introduced into the reactor each hour. Mother liquor and wash waters picked up throughout the plant are recycled to the reactor, adding about 12,600 lb./hr. of solution containing about 29% ammonium perchlorate and 16% sodium chloride to the reaction mixture.

The pH in the reactor is held at 5.5 through addition of HCl. The highly exothermic reaction, proceeding at atmospheric pressure at about 175 F, requires little outside heat. Retention time is about 30 min.

From the primary reactor, the mixture passes through a small secondary reactor (for reaction completion and pH adjustment), into a crystallizer. One of the major problems Wecco encountered in its development work involved control of crystal size. Techniques developed on a batch basis during pilot plant operation proved unsatisfactory when transposed to a large-scale, continuous operation. The problem was eventually solved after a number of trial runs in a pilot plant operated by Struthers-Wells at Warren, Penn., where the necessary operating conditions (retention time and solution purity) to produce the desired distribution of crystal sizes were established.

*Wecco found ammonium perchlorate is more sensitive to ignition when slightly moist, particularly when, it is contaminated with metallic corrosion products, primarily those from copper.

► **Recovery Problems**—This involved recovering the maximum amount of ammonium perchlorate. In the pilot plant operation, Wecco chilled the crystallizer solution down to 14 F, reducing ammonium perchlorate solubility to a low level. But in scaling up, it was decided to avoid even the small losses experienced in pilot plant operations and at the same time eliminate the need for cooling the solution down to 14 F. Accordingly, Wecco developed a 2-stage crystallizing operation involving initial crystallization of the ammonium perchlorate at temperatures obtained by vacuum cooling, followed by another crystallization to remove sodium chloride prior to recycling of the liquor.

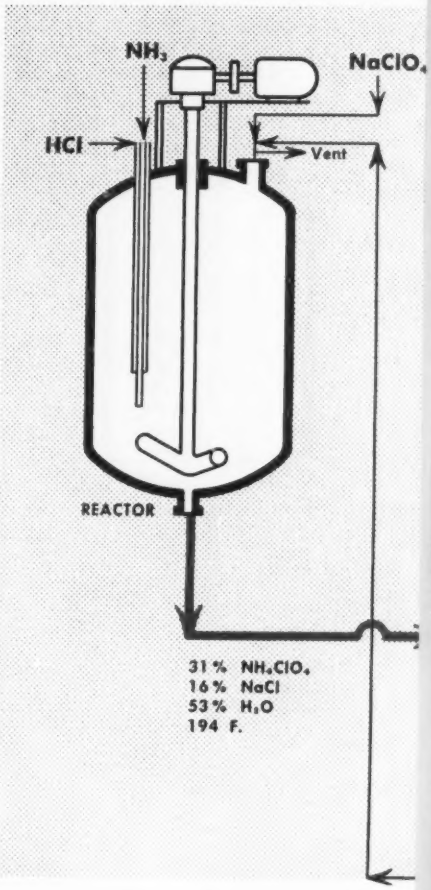
In operation, the mixture from the secondary reactor is cooled to 110 F., precipitating perchlorate while leaving byproduct salt in solution. The slurry formed in the crystallizer contains about 40% ammonium perchlorate in crystal form, about 10% in solution (along with 13% sodium chloride).

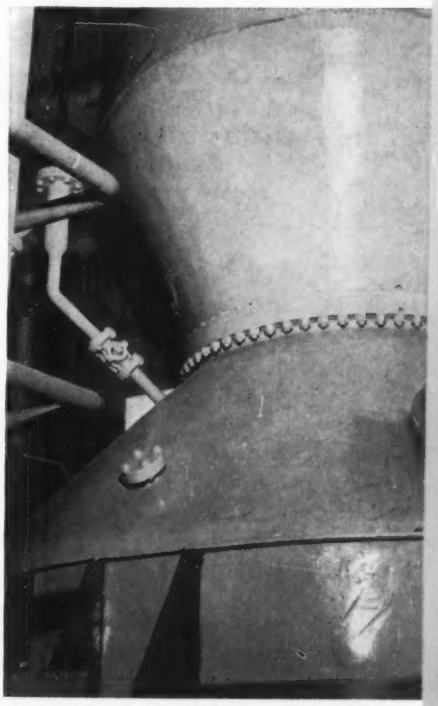
The perchlorate crystals are recovered in a centrifuge, reslurried and pumped to the drying and packaging units. There the slurry, containing about 25% perchlorate in crystal form and about 19% in solution, is centrifuged. Mother liquor recycles to the primary reactor, while a flash dryer centrifuge reduces the moisture content of the crystals to about 0.5%. The partially dried crystals go to a three-stage vibrating pan dryer, from which they emerge with a moisture content less than 0.02%.

After screening, the product is drummed through an automatic weighing scale.

► **NaCl Cycle**—The mother liquor from the perchlorate crystallizer centrifuge is sent to a sodium chloride crystallizer. There the temperature is raised to about 175 F and the solution partially evaporated. About 80% of the sodium chloride is removed from the liquor. First, the crystallizer slurry is sent to a centrifuge feeder, then the concentrated slurry goes to a NaCl centrifuge. Mother liquor is collected in a storage tank. This tank also contains mother liquor from the centrifuge feeder, as well as liquor from the perchlorate drying unit (see flowsheet).

A composite liquor containing 16% NaCl, 55% $H_2O$, 29% $NH_4ClO_4$ recycles to the primary reactor.



**1** VACUUM CRYSTALLIZER, where am
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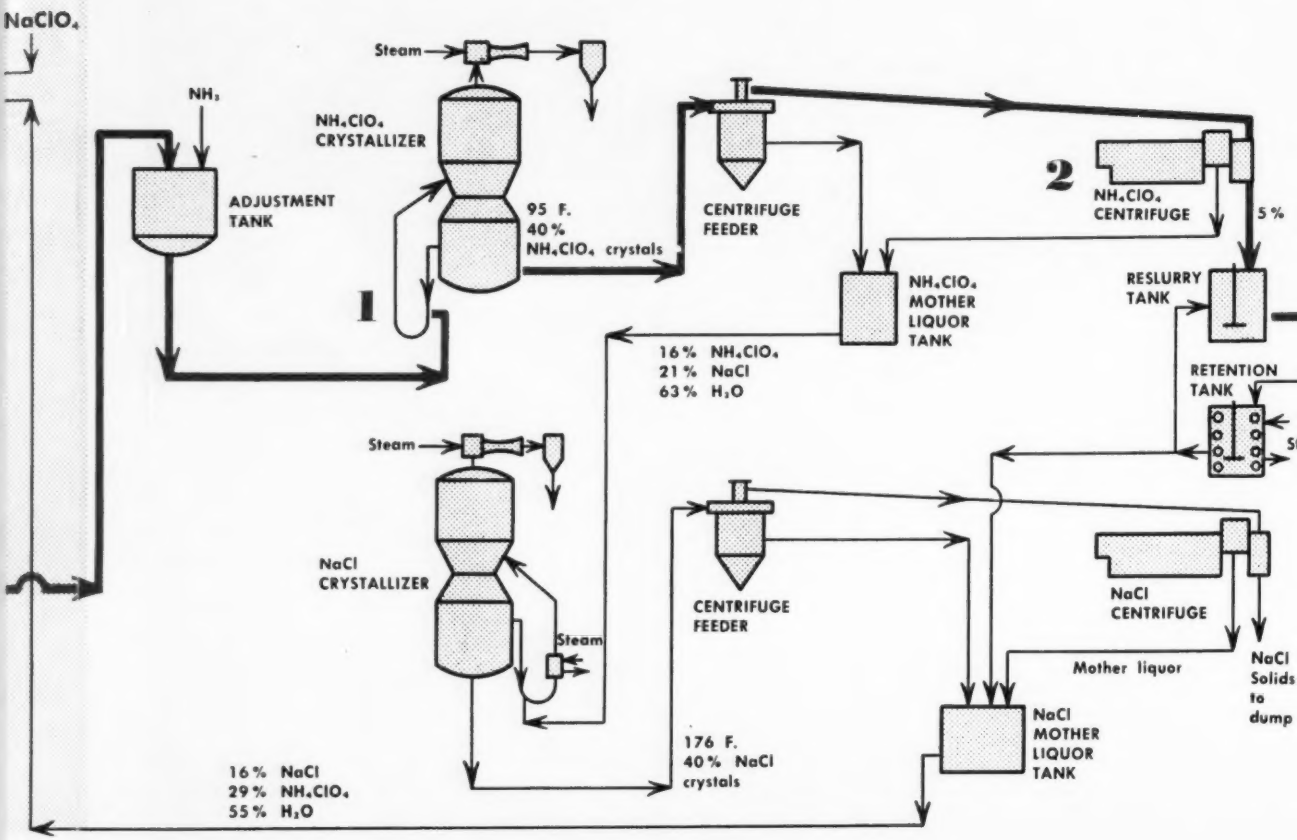


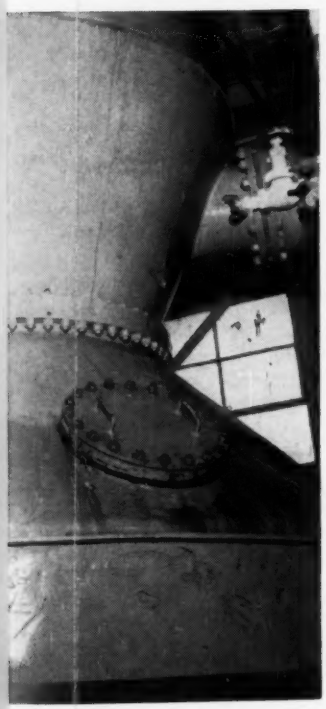

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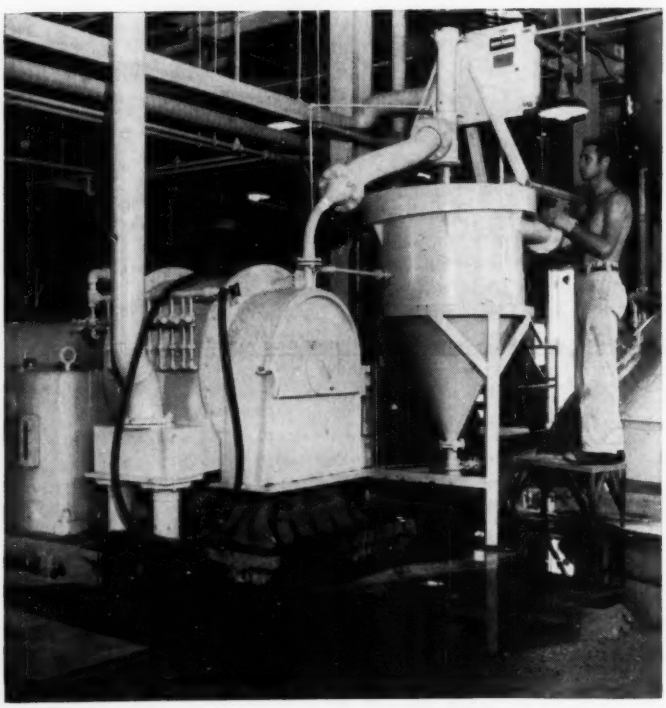
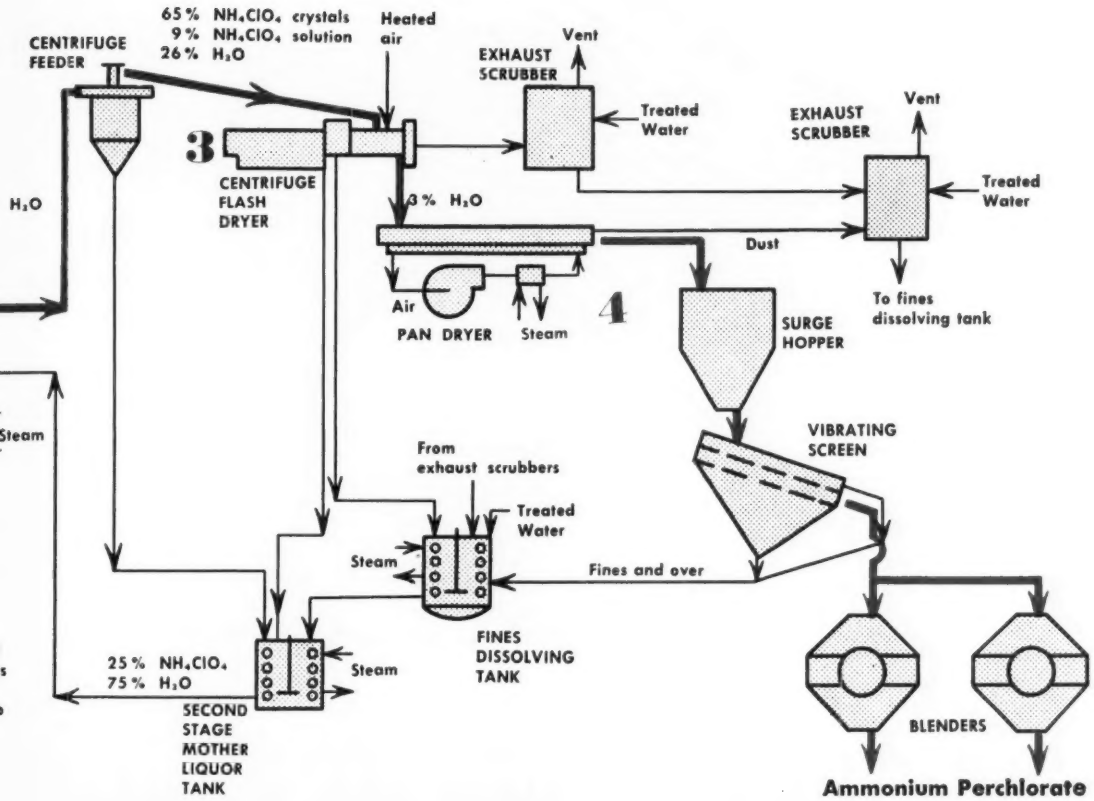
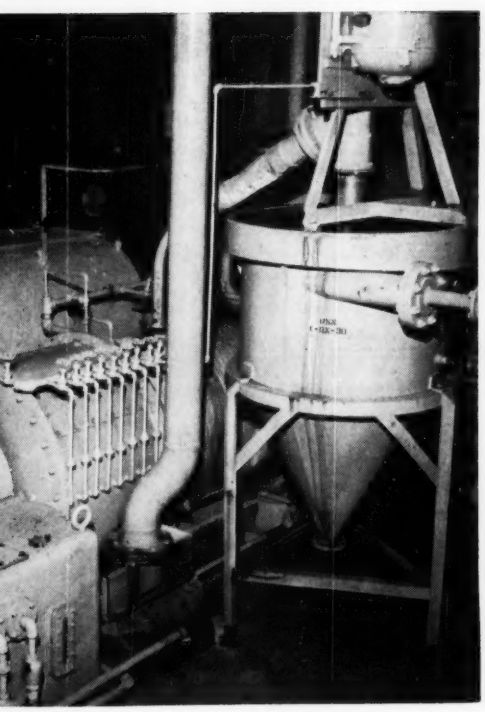


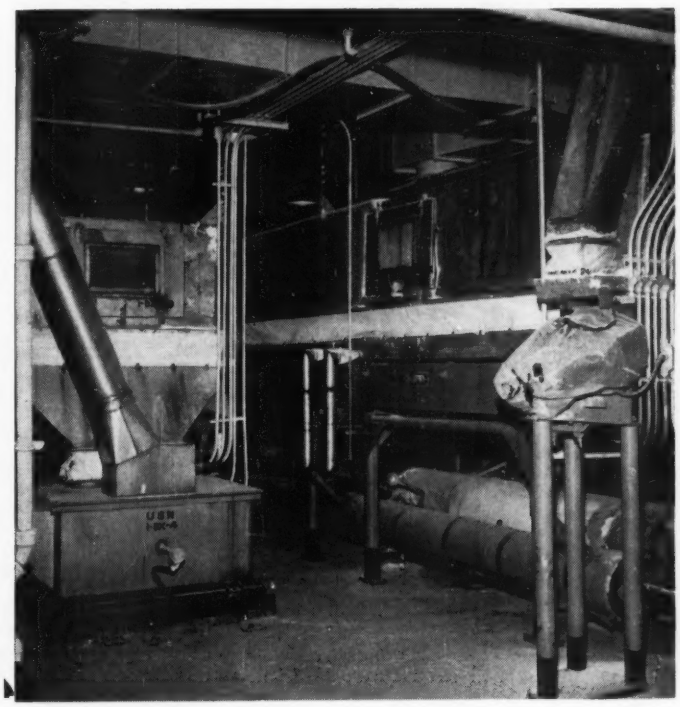
**2** CENTRIFUGE and reslurry equipment. From here ammonium perchlorate crystals are transferred to the drying section.

**3** CENTRIFUGE
flash dried to a n



DRYER. Here the ammonium perchlorate slurry is moisture content of about 0.5%.



4 VIBRATING PAN DRYERS, where the moisture content of the partially dried crystals is lowered to less than 0.02%.

# 3 RIGHTS THAT RIGHT ONE WRONG

The *right* gasket for the *right* flange for the *right* seal. This has been a controlling engineering principle at Flexitallic for 43 years. Engineers know that each Flexitallic Spiral-Wound Gasket is *specifically designed* to do its particular job.

Such definitive application is one of the important reasons why the Flexitallic Gasket finds wider and wider use in extreme or hazardous service — aboard ship, in power plants, aviation, the process industries, atomic research.

Each Flexitallic Gasket is designed and engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having characteristics of a calibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". In diameters to 84" O.D.

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**TEFLON FOR PROCESS APPLICATIONS**

The ideal seal for many process applications is a Flexitallic Gasket with Teflon trapped between edges of stainless steel. Ask for folder, "Teflon in Flexitallic Gaskets."

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

# Over 80,000 operations with these Crane valves
# Maintenance cost: zero

THE CASE HISTORY—More than 6 years of long-day service—with not one penny of maintenance cost to date! That's the record for Crane valves on these Market Forge steam cookers in Chicago's world-famed Conrad Hilton hotel.

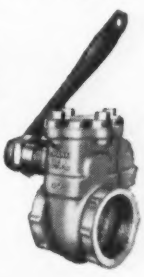
Operated an average of 35 times daily, each of the 24 quick-opening Crane brass gate valves on this installation keeps handling the flow of steam with highest efficiency.

Their cam and lever action remains smooth and positive. They open wide without flow restriction . . . they seat tightly, with no appreciable seat wear or erosive effects. There's no leakage through the cap joint or around the operating mechanism.

The Market Forge Co., Everett, Mass., finds these Crane No. 432 quick-opening valves well adapted to its famous cookers. It's a case of protecting a good product with quality equipment and giving buyers added value. The Conrad Hilton's experience is duplicated wherever these cookers are installed.

Whether you use quick-opening valves as machinery components or in plant service piping, you'll find Crane quality designs for all your needs. Crane makes them in gate and globe types, in brass and iron—for steam, water, oil, gas, air, gasoline, etc.—in a wide range of sizes. Your local Crane Representative can give valuable help in selecting these values for your specific needs.

Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all areas.



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# Superfine
# PIGMENT GRINDING
## with *Double Whizzer Separation*

IF you are making any kind of powdered pigments or commercial fillers, the use of the Raymond High-Side Roller Mill with Whizzer Separation will give you important production advantages:

- **Low Oil Absorption**
- **High Covering Power**
- **Particle Size Uniformity**

**(1) Wide range classification . . up to 99.9% or better passing 325 mesh.**

**(2) Easy fineness regulation, while mill is running, by one simple adjustment.**

**(3) Close product control in fineness and dryness of finished material, as the mill may be equipped with Flash Drying accessories.**

**(4) Higher tonnages per horse-power, due to the Whizzer Separator which increases output 25% to 50% on harder materials, and up to 100% on softer materials.**

For pulverizing paint pigments, including white lead, lithopone and titanium pigments . . . finely ground fillers, such as limestone, natural and synthetic chalks, barytes and various clays . . . Raymond Mills enable you to meet high quality specifications and improve the marketability of your products.

*Write for Raymond Catalog No. 79 for details of Whizzer-Type Roller Mills.*

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*Raymond Division*

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Combustion Engineering - Superheater Ltd., Montreal, Canada

# William Ralph Collings: Man of the Month

**Research-Production Link Sparked Rise of Dow-Corning President**

A new company was being formed. It's directors needed a mighty personable man who could link research and production people and launch new products in short order. William Ralph Collings was given a try. He did it. And now he's Dow Corning's president.

It happened like this. Corning Glass approached Dow Chemical in 1942 with the idea of setting up a joint firm. The late Willard Dow had to find a man who could take a critical look at the reports on organo-silicon chemistry turned out by researchers during the previous twelve years and figure out how to commercialize the results.

What's more, he needed a man who could surround himself with able people and lead them as a team, in which each respected the other's ability to get things done. Bill Collings fitted the bill. And with good reason.

▶ **Fugue**—It was no accident that one of the first things he did was to weld the separate divisions of research, development, production and marketing into one smoothly operating team. He always liked a sort of *gestalt* system: To see the whole operation from start to finish.

Take his work at Dow. Back in the mid-twenties, he converted lab data (for separating $MgCl_2$ from $CaCl_2$ without using lime and sulfur) into a commercial realization—the "nail process." Even designed the plant to carry out his method. It's still operating, too.

Around the same time, he invented and built machines which automatically packed and sealed $CaCl_2$ in the first really cheap waterproof bags (labeled "Dow-Flake").

▶ **More Counterpoint**—Then there was the ethyl cellulose project. Here, he pushed aside a whole maze of literature, on how to treat cellulose with alkalis and react it with alkyl halides, and threaded his way toward an entirely new high-production-rate process for making alkali cellulose. To handle the subsequent reaction with ethyl chloride, Bill designed special reactors himself.

The job was doubly worthwhile. Several years later, he found himself tapping this experience when he had to design reactors for Dow Corning's Grignard process.

▶ **Early Works**—His abilities in individual research showed up some time ago. Let's go back about 40 years to Colling's undergraduate years at Case Institute. A little known fact about his work in those days is that he was the first to produce magnesium metal by the electrolytic decomposition of magnesium chloride.

But the beginnings of his skill in mechanics go back even further. Bill Collings always loved to build things. Though trained in chemical engineering, he'd always had an uncanny sixth sense for mechanical design. (Dow people hint that he probably inherited it from his Scottish ancestors. His uncle, Alexander Winton, was one of the pioneers in the automotive field.)

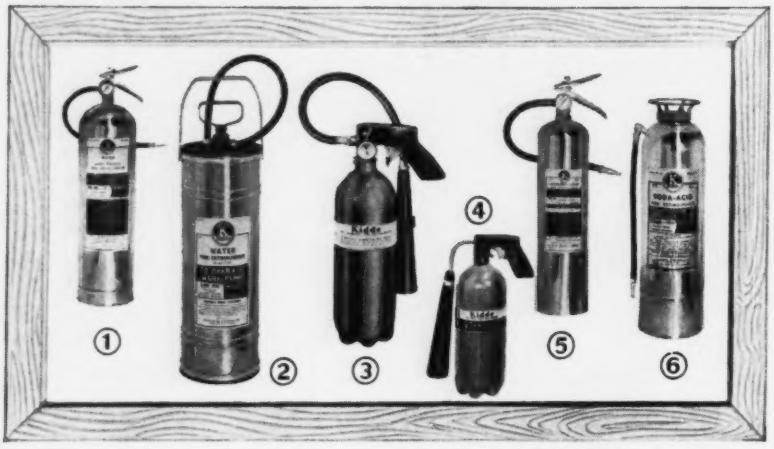
▶ **The Maestro**—Collings' name can be added to those of the order of the green thumb. He takes a special pride in raising a wide variety of lilies. Today, he's one of the country's amateur experts. Dow people say he works mighty hard for his prize specimens and gets a lot of satisfaction out of seeing them grow and burst forth in due time in that glory for which they were created.

And they think he gets the same sort of kick out of molding and developing the young engineers he's chosen to help him explore the horizons of the silicones.

Fact is, his ability to work with people—and what's often tougher: to lead them—is no secret at Dow. Collings' policy is to set an example.

He has a habit of going all out on assignments. Gives constant attention to detail. Check, recheck and check again; that's the way he

# NOW!
# Brand-New Extinguishers Make Kidde Line Most Complete!




**Efficient, dependable and superior in design, the new *expanded* line of Kidde extinguishers now makes it easier for you to choose the *right* extinguisher for every fire hazard!**

**1. Water and anti-freeze.** Now available either air-pressurized or cartridge-operated, in either brass or stainless steel, 2½ gallon capacity.

**2. Pump tanks.** 2½ and 5-gallon sizes, in either galvanized or polished copper tank. Removable all-brass double-action pump throws 40-foot stream.

**3. Dry chemical.** Air-pressurized in 5 or 10-pound capacities, cartridge-operated in either 20 or 30-pound portables. 150-pound capacity wheeled unit for large hazards.

**4. Carbon dioxide.** Portables in 2½, 5, 10, 15 and 20-pound capacities, in either trigger or squeeze-valve models. Also wheeled units in single-cylinder capacities of 50, 75 and 100 pounds.

**5. Vaporizing liquid.** CTC or CBM, pump or air pressure operation with seamless drawn brass shell. Pump capacities 1 to 1½ quarts, pressurized capacities 1 and 1½ quart or 1 gallon.

**6. Foam and soda-acid.** Seamless drawn brass or stainless steel shell, in 2½ gallon size. Also available: 40-gallon soda-acid and foam wheeled units.

**For more information on these and other extinguishers in Kidde's new expanded line, write today for the new Kidde P-8 catalog.**

**Walter Kidde & Company, Inc.**
**1228 Main Street, Belleville 9, N. J.**
**Walter Kidde & Company of Canada, Ltd., Montreal—Toronto**

Kidde

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**NAMES . . .**

works. Perfectionist? Guess so. But whatever the label, he gets results. And he encourages his team to follow suit.

Likes to keep tabs, too, on the morale of his technical people. He prefers to keep in constant touch with his tightly knit team of engineers (which later became the nucleus of Dow's much expanded plastics technical service). Sees to it, too, that they are well informed on events that affect their work and their lives.

▶ **Well-Tuned Notes**—Best way, he finds is to dash off periodic newsletters to be sent to employees' homes. Garnishes on a personal touch by lithographing the handwritten original, illustrated with his own photos. The idea grew out of a "from me to you" series he'd written from Europe. The letters were so popular that he made them a permanent part of his program.

▶ **Coda**—If you ask Bill's friends and associates at Dow Corning to recall the firm's early days, they'll start by describing their parent companies' offer of resources. They'll tell you that Dow and Corning said, in effect, "Here's a new chemical continent to explore. Here's the money, background research and pilot-plant development, and a heap of new products with some of the most unusual combinations of properties ever to come up the chemical pike. Now, go to it!"

But if you ask Vice President Shailer Bass, he'll add, "Perhaps the most important thing they said was, 'Here are some good people, experienced in the field of high polymers, and here's Bill Collings to set the pace.'"

Dr. Collings' inspiration is rated in Midland as the biggest single contribution to the new company. —MAG

**John Bowles,** has been appointed president of the Rexall Div. of Rexall Drug Co.

Manufacturing Chemists' Assn. has appointed six new committee chairman: **John Fistere,** pres., Mallinckrodt Chemical; **Hans Stauffer,** pres., Stauffer Chemical; **R. Hansen,** asst. to the pres., Al-

lied Chemical; **E. Cleaves,** VP, Celanese; **O. Tracy,** pres., Enjay; **H. Jacobs,** duPont.

**J. C. Harris,** director of the application research dept. at Monsanto's merchandising div. in Dayton, O., will receive the 1955 Achievement Award of the Chemical Specialties Mfrs'. Assn. for work with detergents and surface active agents.

**L. F. Williams**

At a recent board of directors' meeting, L. F. Williams was elected president of the Cooper-Bessemer Corp.

Formerly, Mr. Williams held numerous positions in the management of the firm's Mt. Vernon, O., and Grove City, Pa., plants. Most recently, he had served as secretary and assistant to the president.

**Luigi Pollara** has been named head of the dept. of chem. and chem. eng. at Stevens Institute of Technology, Hoboken, N. J.

**B. Turner,** vice president in charge of research and eng. for Ethyl Corp., has been elected executive vice president.

**Robert Williams** has been elected to the board of directors of General Aniline & Film Corp.

**John Church** has been appointed VP in charge of research & dev. for the Mastic Tile Corp. of America.

**Glenn C. Putnam** has been named technical supt. at du Pont's Victoria, Tex., plant. **Manning W. Riser,** div. supt. of production at


*New...* FreeFlow GASKETS

JOHN CRANE

*made of* TEFLON*

"JOHN CRANE" FreeFlow Construction
Gasket flush with pipe I.D.—allows completely unrestricted flow.
No air pocket—insert flush with I.D. of envelope. No danger of rupture due to expansion of entrapped air at high temperatures.
AIR
Ordinary "Wishbone" Construction
Envelope extends beyond I. D. of pipe, causing flow restriction and turbulence.
Expansion of entrapped air at high temperatures presents danger of gasket rupture.

**FOR EVERY CORROSIVE SERVICE**

"John Crane's" FreeFlow construction and chemically inert Teflon have been combined as *the* answer for gaskets in corrosive service. This new construction assures a flush fitting with the I.D. of the pipe and the inner wall of the Teflon envelope, not possible with the ordinary "wishbone" type gasket. (See drawing above).

This means elimination of:

1. Flow restriction and turbulence in the line.
2. Danger of rupture at high temperature due to entrapped air between gasket insert and Teflon envelope.

"John Crane" Teflon FreeFlow gaskets are impervious to practically every known chemical or gas and are unaffected by temperatures from −100° to +482°F., depending on the insert material. They are available in all shapes and sizes for a wide variety of applications, such as glass lined, porcelain, pyrex and similar equipment, including reactor kettles and pipes, distillation columns and nozzles.

Request full information on "John Crane" FreeFlow gaskets for your particular requirement. Ask for our informative booklet, *The Best in Teflon*, for other important technical and application data. Crane Packing Company, 1809 Belle Plaine Ave., Chicago 13, Illinois. *In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.*

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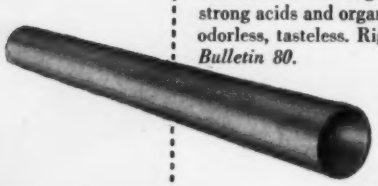
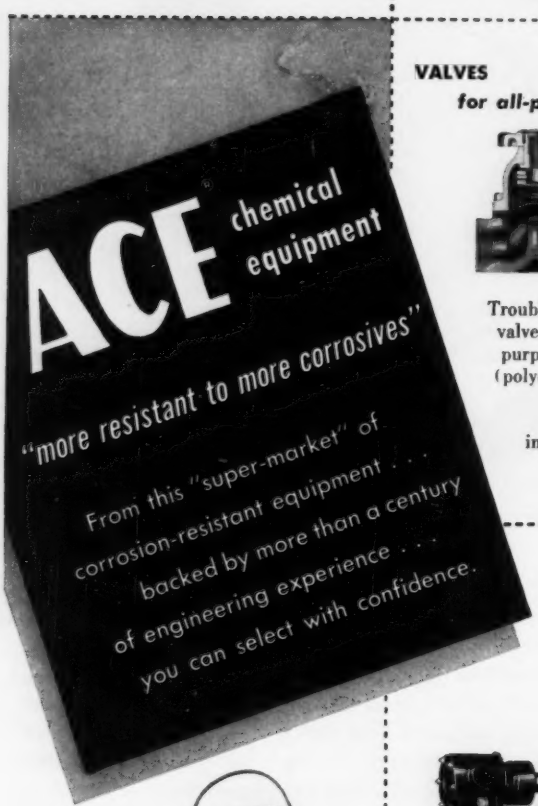
*DuPont trademark

JOHN CRANE CRANE PACKING COMPANY 38 YEARS INDUSTRIAL PROGRESS

**TOUGH ACE-ITE PLASTIC PIPE**

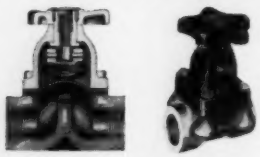
General-purpose moderately priced rubber-plastic pipe handles most common chemicals to 170 deg. F. . . . except few strong acids and organic solvents. Tough, odorless, tasteless. Rigid pipe ½" to 6". *Bulletin 80.*




ACE chemical equipment
"more resistant to more corrosives"
From this "super-market" of corrosion-resistant equipment . . . backed by more than a century of engineering experience . . . you can select with confidence.

**VALVES**

***for all-plastic piping systems***

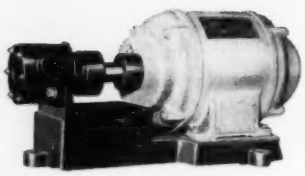


Trouble-free plastic diaphragm valves . . . choice of general-purpose ACE-ITE, ACE PARIAN (polyethylene) or ACE SARAN. Handles most corrosive chemicals and food ingredients. Sizes ½" to 2", 50 psi. at 77 deg. F. *Bulletins 80 and 351.*

**ACE-HIDE**
**ACID PAIL**

***Practically indestructible***

Its made of a new rubber-plastic material that's tough, resilient, suitable for handling most acids and alkalis. 3-gal. size. Easy-pour, drip-proof spout. Also 1-qt. and 2-qt. dippers, hard rubber bottles, etc. Write for name of nearest dealer.



**MIGHTY MIDGET**

***for pumping acids***

Jabsco neoprene-impeller pump made of ACE hard rubber out-lasts, out-pumps anything in its pressure, size and price class. Capacity from 15 gpm. at 22 ft. head to 5 gpm. at 72 ft. head. *Ask for free Bulletin 97.*

**ACE rubber and plastic products**

**AMERICAN HARD RUBBER COMPANY**
**93 WORTH STREET • NEW YORK 13, N. Y.**

**NAMES . . .**

the Sabine River Works, has been transferred to Parkersburg, W. Va. **John C. Provo** will replace him. **Mart J. Hartig** is the new tech. supt.; and **D. Holt Waring** is his asst.

**Leonard Reichle** has been appointed Nuclear eng. director for the Ebasco Services, Inc., newly formed atomic eng. div. Formerly, Mr. Reichle had served with the USAEC as asst. director of the reactor dev. div.

**Fred Adams**

The president of G. M. Basford Co. has been elected to the board of directors of the Sun Chemical Corp.

Until he became associated with Basford, in 1942, he had been assistant advertising manager with Mathieson Alkali Works. Adams is a graduate of NYU with a B.S. in chemical engineering.

**Henry J. Conroy** is the new technical consultant in rubber research at Armour Research Foundation, Illinois Institute of Technology.

**Lawrence A. Roe** has been appointed mineral beneficiation engineer by the eng. div. of International Minerals & Chemical Corp.

**Zinn Garrett** has been named assistant to the president of The Institute of Paper Chemistry. Mr. Garrett has been with the US foreign service.

**Leonard Adler** has joined Metal & Thermit as senior div. engr. **Richard W. Davis** will be chief

engr. at the firm's Rahway, N. J., lab. **Alvin Pollock** is a process engr. at Carteret, N. J. Formerly, Mr. Adler had been with Olin Mathieson; Mr. Davis, with Gen'l Aniline.

**Clifford A. Hampel** has joined the Fansteel Metallurgical Corp., as manager of the chemical equipment div. Mr. Hampel holds 35 patents on the manufacture of chlorine compounds and their uses.

**Fred Bellinger,** professor of chemical engineering at Georgia Tech, is on leave with UNESCO in Egypt. Assignment? To set up a research lab there.

**K. E. Honeycutt** has been promoted to group leader and **J. R. Swift** to party chief in the eng. dept. of Dow Chemical's Texas Div. **L. T. McBeth** has joined the dept. as a design engineer.

**Lester Horwitz** of Midwest Research Institute, is the recipient of the Technical Paper Award of the Photographic Society of America for his paper on "Mechanisms of Color-Sensitization."

**James Killian, Jr.,** pres. of MIT, will serve as chairman of the Organization and Planning Comm. of Atoms for Peace Awards.

**Frank E. Sullivan** has been promoted to the position of chief engineer—industrial processes for The De Laval Separator Co.

**Richmond M. Stampley** is the new manager of the Western Filtration Sales Div. of Dorr-Oliver, Inc., with headquarters in Oakland, Calif.

**Donald Price,** formerly associated with Oakite Products, has set up a consulting service in the areas of synthetic detergents and surface-active agents.

**Erwin J. Campbell** has been appointed supervisor of process research, research and development


**NO SHAPE TOO SCREWY**

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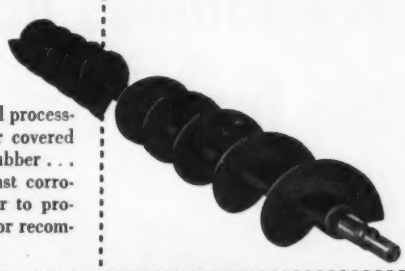

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**NAMES . . .**

dept. for Acheson Colloids. **William Oliver** is a new process development engineer.

**Travis Stevens** has joined the organic chemistry group of Rohm & Haas' chemistry section.

**George Ham** will now head the J. T. Baker Chemical Co. dept. of research. Formerly, Dr. Ham was with Chemstrand in Decatur.

**Alvin M. Weinberg**

The former research director of the Oak Ridge Nat'l Laboratory has been appointed director of all operations.

Just 10 years after his first association with the Lab, Dr. Weinberg will head the nation's chief atomic research operations. In 1942, he had joined the Manhattan district's metallurgical project where he contributed to the design of the nuclear reactors used in the production of plutonium.

This summer, Dr. Weinberg served as an official delegate to the "Atoms for Peace" conference, in Geneva, where he delivered two papers on reactor systems.

**Cornelius Coakley** is the director of operations at the New York plants of National Aniline.

**Harold C. O'Connor** has been appointed supt. of the Silicon Carbide Section of Carborundum's Electro-Minerals Div.

**J. T. Faubion** has been named manager of production coordination for Dow's Texas div. **D. G. Griffin** will be supt. of the production control dept.

**Robert A. Latimer** has been chosen process design consultant for the Tonawanda Laboratory of Linde Air Products.

**Paul E. Peters** has been appointed manager of administration at Linde Air Products Speedway Laboratory in Indiana.

**R. Lindley Murray,** former president of Hooker Electrochemical Co., has been elected chairman of the board of directors. He will continue as the firm's chief executive officer.

**Raymond W. Hess** has been appointed coordinator of pollution research for National Aniline's Buffalo, Chesterfield and Moundsville plants.

**Paul F. Bente** and **Alfred T. Hawkinson** have been promoted to section managers with du Pont's electrochemicals dept.

**Gerard W. Farnan, Munson H. Tix, Robert J. Hummel** are new members of Monsanto's Plastics division.

**John Hawley** has been assigned to Pennsalt's technical service staff. **Everett A. Bruce** is now assistant to the manager of manufacturing for the industrial chemicals div.

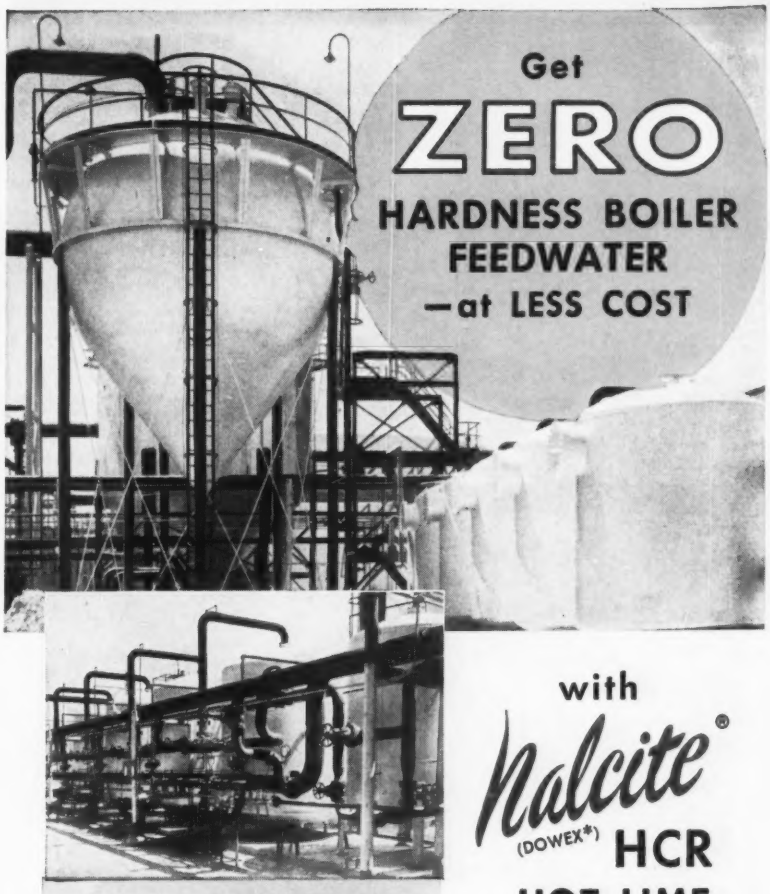
**Merritt L. Kastens,** asst. director of Stanford Research Institute, has been elected to the board of directors of the ACS' div. of chemical marketing and economics.

**Dale Strasser** is the new materials handling engineer for Witco Chemical Co. He had been with Continental Carbon.

**Robert Burrows** is now manager of the chemical products plant of GE's Lamp div., in Cleveland.

**Augustine R. Marusi,** president of Borden's chemical div., has been elected a VP of Borden Co.

**J. E. Wood** has been appointed assistant general manager of Esso's chemical products dept. He suc-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**NAMES . . .**

ceeds **Clayton Beamer** who is now general manager of Chemical Products for Imperial Oil Ltd. (Canadian affiliate of Standard Oil—N. J.)

**Edward Peters** has been named assistant laboratory director of Cadet Chemical Corp. Formerly, Dr. Peters was employed by the Upson Co.

**R. Kirby Shirley** and **Pearson E. Neaman** have been elected senior vice presidents of Freeport Sulphur Co.

**John Crowther** is the new product manager for chlorinated solvents of Frontier Chemical Co.

**Henry F. Payne** has retired from American Cyanamid to become research professor of organic coatings, at U. of Florida's dept. of chem. eng.

**A. J. Fausek** is the new chairman of the board for Modern Eng. Co. Other officers are: **I. Fausek**, president; **W. Reedy**, VP in charge of production.

**B. W. Birmingham** has been appointed chief of the Cryogenic equipment section and asst. chief of the eng. div. for the Nat'l Bureau of Standards' Boulder Labs.

**Robert H. Kittrell** is the new manager of Flintkote Co.'s Canec plant in Hilo, T. H. He succeeds Ken Sauer who is now in the Los Angeles Tile-Tex div.

**Leonard L. Sutker** has been appointed director of research and development for Neatsfoot Oil Refineries Corp.

**Herman Pines** has received the $1,000 Fritzche award for research in the field of essential oils. Mr. Pines is a member of the Northwestern U. staff.

**Laurance Rockefeller** has been elected a member of the board of directors of Olin Mathieson Chemical Corp. **Robert H. Evans** is now VP and general manager

of the forest products div.; **P. R. Moore** will be VP of the division's paper operations; and **W. H. Brown**, VP of lumber works.

**OBITUARIES**

**George Skakel, Sr.**

The chairman of the board of directors of the Great Lakes Carbon Corp., and his wife, Ann, died October 3rd when their company plane crashed near Union City, Okla.

After the World War I, Mr. Skakel became a partner with Walter Gramm (present senior VP at Great Lakes) in the formation of Great Lakes Coal & Coke Co., Chicago. When the firm was incorporated, he became president and a director, and held these positions until a few years ago.

Active in civic affairs, Mr. Skakel was also a director of the Nat'l Hosp. for Speech Disorders, in New York.

**Charles Wellington Simmons** of the chemical engineering dept. at Lehigh Univ., passed away on Sept. 24th after a prolonged illness.

**Fred E. Palmer,** 55, plant manager of Industrial Rayon Corp.'s Painesville, O., plant, died at his home on October 2nd, after a brief illness.

**John B. Merrill** and **James E. McGarr,** of Sylvania Electric Products Inc., were killed in a plane crash near Laramie, Wyo., on October 6th. Mr. Merrill had been VP-Operations for the tungsten and chemical division; McGarr was the general manager.


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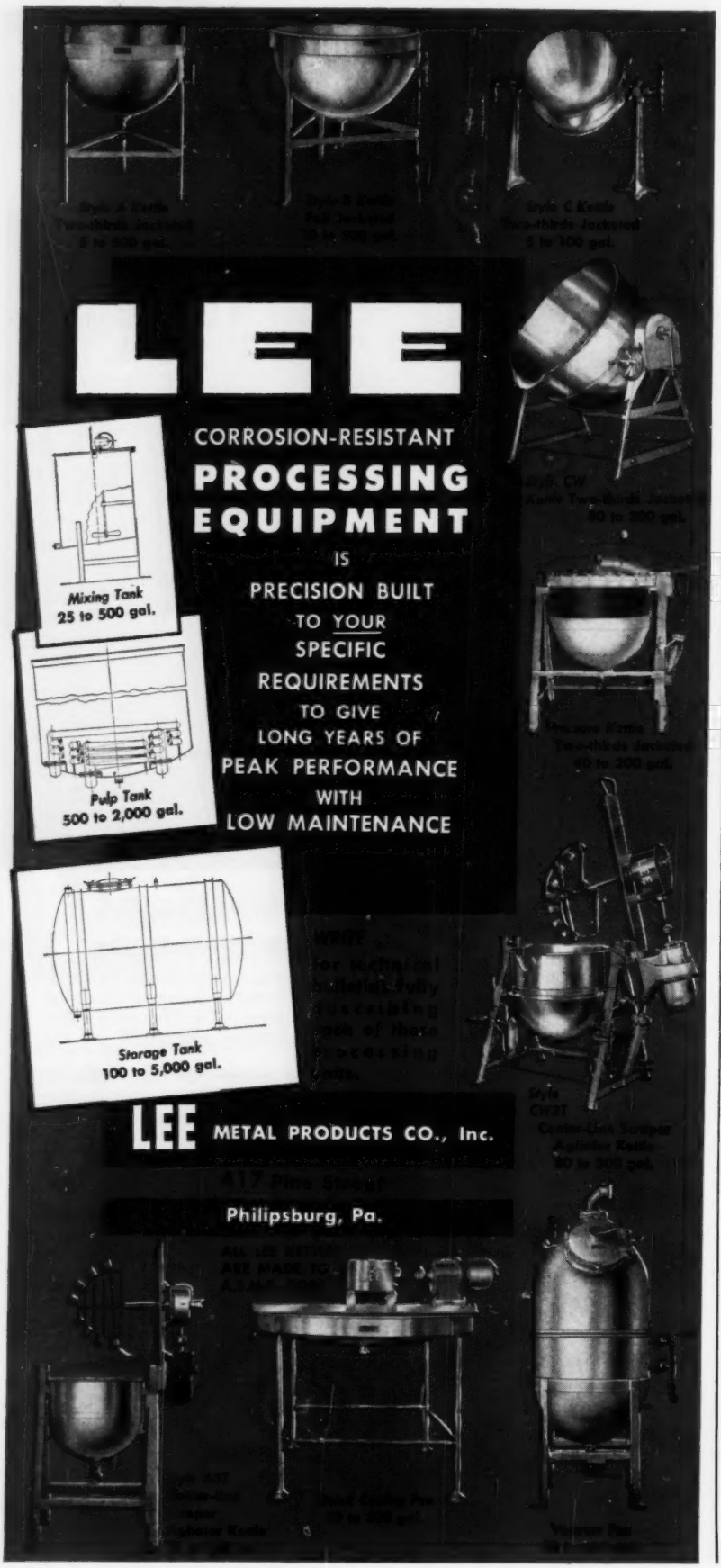


THIS MONTH'S

## *Letters:*

### Science vs. Honest John

*Sir:*

On observing the optimum 12-year trade-in time in the automobile example in Dr. Frederic C. Jelen's excellent article on capitalized costs (Aug. 1955, pp. 181-9), I was led to wonder if perhaps the Theory of Games of Strategy and Decision Theory Models of Operations Research might not be equally essential for a realistic replacement decision.

JACK C. LEONARD
Creelman Associates
Cleveland, O.

► *Dr. Jelen's two articles on capitalized costs (the first appeared in Feb. 1954, pp. 199-203) have stimulated a tremendous amount of interest among engineer-economists. In addition to the letters above and below, see pp. 183-4 in this issue for more "pro and con" on capitalized costs. Earlier correspondence appeared in this department in Apr. 1954 (pp. 378-380); June 1954 (pp. 407-410); Aug. 1954 (pp. 329-331).*

*Dr. Jelen has promised us a third article presenting a completely new concept in the application of capitalized costs—the solution of problems in engineering economics where inflationary factors are involved. Watch for it.*—ED.

### Prefers End of Year

*Sir:*

I have been interested in the articles by Dr. Jelen regarding capitalized cost. Since they are at variance in one respect with the treatment in my new text, "Process Engineering Economics," I believe this point should be clarified to avoid possible confusion.

The point of difference is in the consideration of the capitalized cost of annual expense. The difference is a matter of opinion, but my treatment is in accord with Grant, "Principles of Engineering Economy."

Dr. Jelen assumes that the entire expense occurs at the start of the year. Therefore its cost for one year is taken as $(1+i)$ times the actual expense, where $i$ is the an-

nual interest rate. The resulting product is then divided by $i$ to obtain its capitalized value.

In my treatment the entire annual expense is assumed to occur at the end of the year. (This is the same time point used for annual capital charges.) The capitalized value then is very simply obtained by dividing by $i$.

Mathematically, the relationships might be developed as follows:

Defining capitalized cost $K$ as the equivalent capital that must be available $m$ years from now for renewal of the equipment and which must include also the necessary capital to provide for annual expenses $M'$ occurring at the end of the year, the equation is:

$$K = \frac{1}{i}\left[ Ci + \frac{Ci}{(1+i)^m - 1} - \frac{Li}{(1+i)^m - 1} + M' \right] \quad (1)$$

where $C$ is the value of equipment at the start of the period under consideration and $L$ is the salvage value at the end of $m$ years. The term $i/[(1 + i)^m - 1]$ is the annual sinking-fund-deposit factor, and salvage value is considered as a negative cost.

Eq. (1) defines capitalized cost simply as the algebraic sum of all the recurring annual charges divided by the interest rate. This applies generally for any finite value of $m$.

Dr. Jelen is in accord with this except for the last term, which he considers as $(1 + i)\ M'$ by assuming that this expense occurs at the start of the year. There could be just as much argument advanced for considering it in the middle of the year, but I feel that the simpler form of Eq. (1) is better than either alternative, since all terms are consistent. This assumption could be critical in cases where annual expense is large relative to the other terms, because the interest on it might be sufficient to control a decision regarding a replacement.


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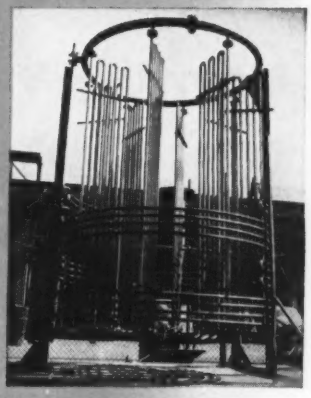

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**PRO & CON . . .**

For clarity several alternative forms of Eq. (1) might be written:

$$K = \frac{C(1+i)^m}{(1+i)^m - 1} - \frac{L}{(1+i)^m - 1} + \frac{M'}{i}$$

$$= CF_m - LG_m + M'F_1 \qquad (2)$$

$$K = C + \frac{C - L}{(1+i)^m - 1} + \frac{M'}{i} \qquad (3)$$

Eq. (2) uses Dr. Jelen's factors $F_m = (1 + i)^m/[(1 + i)^m - 1]$ and $G_m = F_m - 1$. However, my factor $F_1$ for annual expense is $1/i$ rather than Dr. Jelen's $(1 + i)/i$. This difference is due simply to the use of a different basis for considering when the annual expense occurs.

The simplicity of Eq. (1) is illustrated by applying it to Example 1 in the Aug. 1955 article. Annual charges are:

| | |
|---|---|
| Interest on $C = (2,500)(0.08) =$ | 200 |
| Decline in salvage value for 1 year $= 2,500 - 1,500$ | = 1,000 |
| Annual expense | = 5,000 |
| Total | = 6,200 |
| Capitalization of annual charges $= 6,200/0.08$ | = 77,500 |

Thus, an equivalent capital of $77,500 provides annual interest of $6,200 to (1) pay interest of $200 for one year on equipment worth $2,500, (2) allow for the loss in value of $1,000 for the year and (3) provide $5,000 for operating expense.

If Dr. Jelen's $F_1$ factor is used in a similar calculation procedure the annual expense first must be multiplied by 1.08 to give $5,400 before capitalizing. This adds one step in the calculation. While not confusing in this problem it might become so in a more complicated one.

H. E. Schweyer
University of Florida
Gainesville, Fla.

► *Dr. Jelen expresses a different viewpoint in his reply which follows.*—Ed.

**Prefers Beginning of Year**

*Sir:*

Inasmuch as it is the spirit of capitalized cost to use the present as a reference time, I refer yearly

expense to the bginning of the year rather than the end. This is shown clearly on p. 188 of the Aug. 1955 article in the discussion of equivalent uniform yearly cost.

Prof. Schweyer evidently prefers to have his yearly expense $M'$ refer to the end of the year. However, this does not make the expense referred to the end of the year the actual expense. It is just as right to refer to the beginning of the year, and in the case of capitalized cost consistency demands it.

Because Prof. Schweyer's $M'$ and my $M$ differ by one year, they are related by the equation

$$M' = M(1 + i)$$

In the example cited, Prof. Schweyer should have computed the annual expense referred to the end of the year as (5,000) (1.08) = 5,400, to get total annual charges of $6,600 and a capitalized cost of $82,500, as given in the article.

Mathematically, it makes no difference whether the expense be referred to the beginning or the end of the year; the capitalized cost is the same. All that happens is that we use different figures in different equations and get the same results.

F. C. Jelen
Allied Chemical & Dye Corp.
Syracuse, N. Y.

**Neat Way to Index Articles**

*Sir:*

Here's the solution to a problem that plagued me for quite some time:

Often I'd remember seeing an article on a subject I was studying; the only trouble was I didn't remember in which magazine and in which issue. If the article had appeared recently, every issue of the probable magazines must be searched back to the point where yearly indexes or abstract indexes could be used.

The solution turned out to be quite simple.

Now I remove the index pages from the magazines each month and file them in a loose-leaf note-


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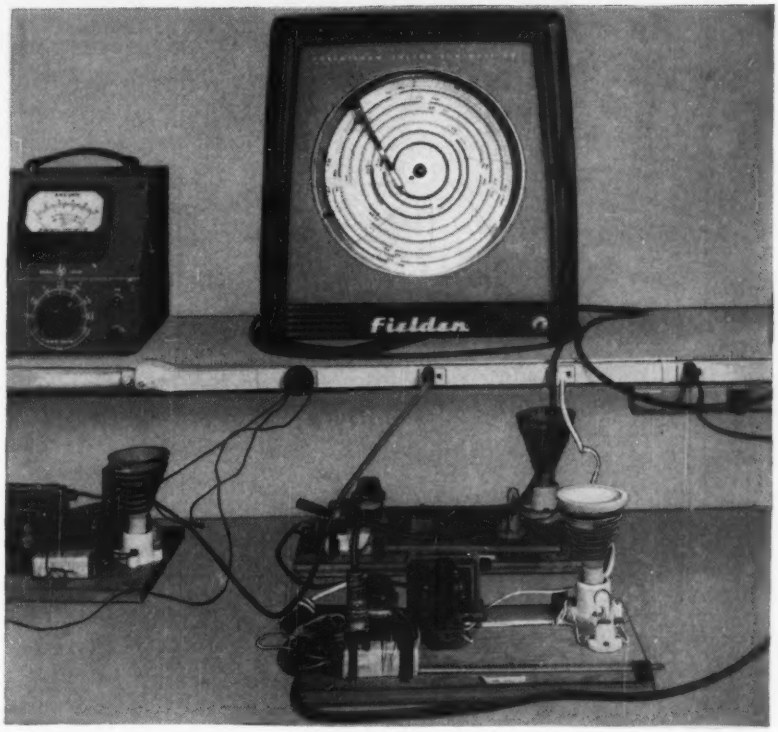


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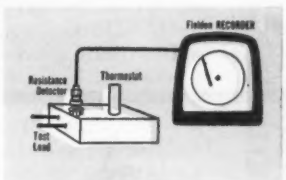
AC or DC loads are applied to a copper block containing a resistance temperature detector and the thermostats under test. As temperature changes, the resultant change in resistance is recorded by the *Fielden* Recorder.

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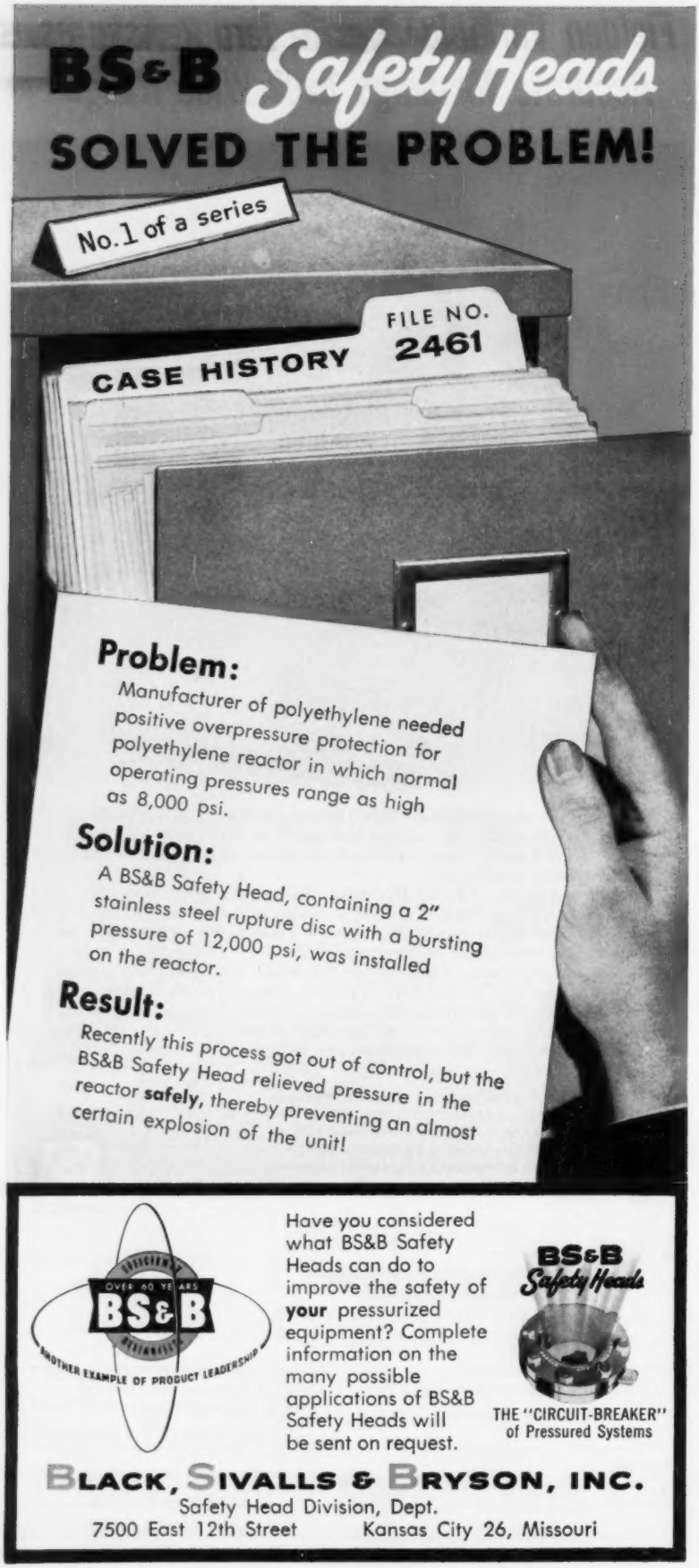
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**PRO & CON . . .**

book. It's a simple matter to leaf through these index pages when I'm looking for an article.

This loose-leaf index can be discarded as soon as the yearly indexes appear.

MERRITT G. MARBACH
Rose Polytechnic Institute
Terre Haute, Ind.

▶ *Neat system, this, for feature articles. In the case of CE, it can also be used for most feature departments—such as What's Happening, Process Equipment News or Chemicals & Raw Materials—since each of these has its own contents "box" each month.—ED*

### Mistaken Identity

*Sir:*

This is to call attention to an error in the September 1955 "Bio-Oxidation" Report.

In the table of performance data on p. 195, the last item is incorrectly identified as the "Aero-Accelator" process. The listed data are from another type of high-rate plant, not an Aero-Accelator. However, results from this plant are satisfactory, as apparent from the high loading and low M.L.S.S.

The following data represent typical Aero-Accelator performance on sewage:

BOD loading: 0.78 lb./day/lb. M.L.S.S.
Raw BOD: 330 ppm.
M.L.S.S.: 3,800 ppm.
Aeration detention: 1.4 hr.
BOD reduction: 89%

T. L. MOORE
Gibbs & Hill, Inc.
New York, N. Y.

▶ *We suggest that our readers enter the correct figures at the indicated location in their copies of the September issue. The error was caught in time to make the correction in reprints of this report which are now available.*

*We call your attention to another author's correction which follows.—ED.*

### Penalty on Efficiency

*Sir:*

Mr. Frank J. Allen, York Corp., has called my attention to an important omission from my article on "Charts for Pressure Vessel Design" (Apr. 1955, pp. 172-5). The

last column in Table I (p. 172) should bear this footnote:

"Vessels which are not radiographed shall be subjected to spot examinations in accordance with Paragraph UW-52. Vessels which are neither radiographed nor subjected to the prescribed spot examinations shall be designed with a joint efficiency equal to 80% of the values given here."

In the example given on p. 173, the joint efficiency of 0.80 applies to a vessel which has been subjected to the prescribed spot examinations. If no spot examinations were performed, the joint efficiency would be (0.80) (0.80) = 0.64. Thus, the required thickness under these conditions would be 0.22, instead of 0.18 in.

C. J. MAJOR
State University of Iowa
Iowa City, Iowa

**Add Mississippi**

*Sir:*

I respectfully call to your attention that the Department of Chemical Engineering at the University of Mississippi is accredited by the Engineers' Council for Professional Development and the American Institute of Chemical Engineers. It was not, however, included in the list of the "1955 Committee of Awards" as announced on pp. 185 and 186 of the February issue of *Chemical Engineering*.

FRANK A. ANDERSON
Chairman
Dept. of Chemistry & Chemical Engineering
University of Mississippi
University, Miss.

▶ *We apologize for our slip. "Ole Miss" certainly is on the accredited lists, as pointed out by Professor Anderson.*—ED.

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**We welcome short, pertinent letters from our readers giving their opinions on developments in the chemical engineering profession and in the chemical process industries. Address the Editor, Chemical Engineering, 330 West 42nd Street, New York 36, N. Y.**

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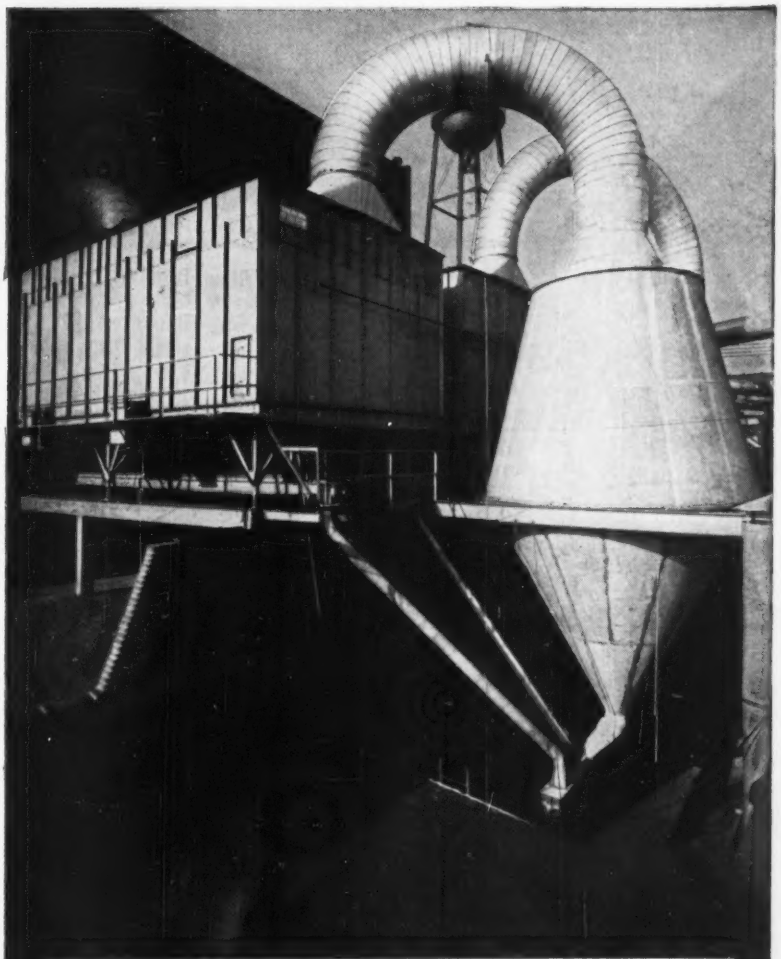

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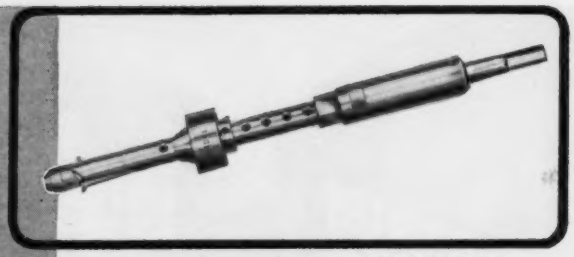

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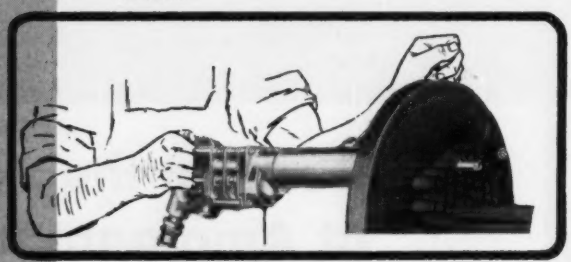

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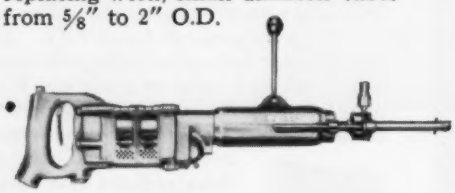

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THIS MONTH'S

# *Technical*

## A Stereotyped Book Review[1]

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. Vol. 14: Thermodynamics to Waterproofing. Edited by Raymond E. Kirk and D. F. Othmer. Assistant editors: Janet D. Scott and Anthony Standen. Interscience Publishers, New York. 980 pages. Subscription price $25.

"Once again it is our pleasure to bring to your attention another addition to the valuable[2] and growing[3] series on your reference shelf.

"The editors[4] have again called on recognized experts[5] for latest and best data. The entries[6] cover a segment[7] of current technological practice.[8]

"As usual, chemical engineers will find several[9] general survey articles[10] that are well done. And

FOOTNOTES

1. This stereotyped book review first appeared in *Chemical Engineering* in March 1954 (p. 394). It was prepared as a standard review for the eleventh and subsequent volumes of the Encyclopedia of Chemical Technology. It is here reprinted again to announce Vol. 14, just published. Naturally, these footnotes had to be modified somewhat. Look for it again in about seven months when the last volume appears to wind up the series with about 300 pages of articles and 600 pages of index.
2. See *Chem. Eng.*, Feb. 1948, p. 285, for an appraisal of the value of the series.
3. At a rate of about 1.7 volumes per year.
4. Kirk and Othmer (see *Chem. Eng.*, Feb. 1948, p. 285), Scott and Standen (see *Chem. Eng.*, May 1950, p. 261).
5. Ninety-one.
6. Fifty-four.
7. Thermodynamics to Waterproofing.
8. Mostly American practice is reported. This accounts in part for the widespread interest and the many orders the publishers receive from other countries.
9. Ten.
10. Trade-Marks, Type Metals and Plate Metals, Ultrasonics, Unit Operations and Unit Processes, Units and Their Symbols, Vacuum Tubes, Industrial Wastes, Water, Industrial and

## Bookshelf

L. B. Pope

again there are entries which are too short[11] or too long.[12]

"The articles[13] discussing various industry segments[14] are—on the whole—adequately presented and about the right length. Whole industries are covered with the usual attention to timeliness,[15] accuracy[16] and detail.[17]

"Techniques[18] are normally represented[19] in this segment of the alphabet.[7]

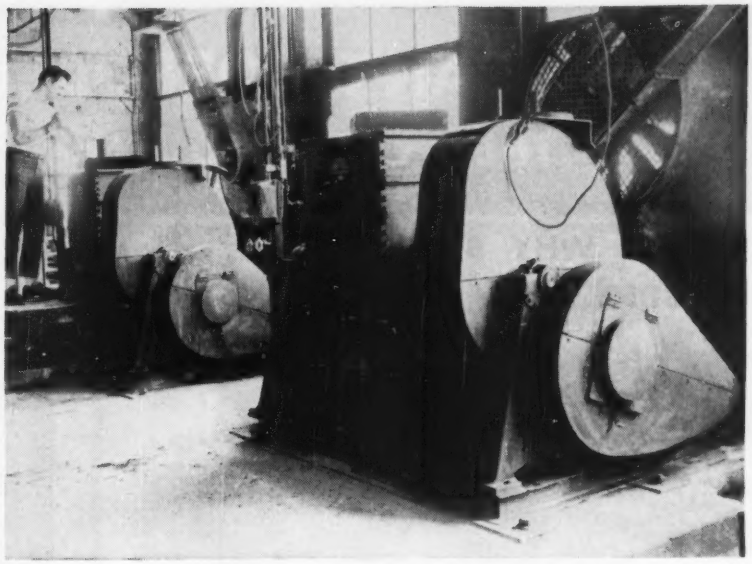
"A number[20] of the discussions are about arts and sciences[21] which are of fringe interest to chemical engineers. These are, in some cases, extremely interesting reading.[22]

"Of major value are some of the articles in the largest[23] category—groups or families of compounds.[24] These are variable in length[25] as well as variable in intrigue[26] and

FOOTNOTES

Municipal Water, Waterproofing and Water Repellency.

11. Unit Operations (4 pages).
12. Vitamins (98 pages).
13. Five.
14. Tobacco, Turpentine, Varnishes, Vinegar, Wallboard.
15. "An increasing interest in the question of the effect of tobacco on health may be expected to produce new knowledge through research being planned and conducted. . . ."
16. " 'Thionic' acid in this sense should not be confused with the term thionic acid (*q.v.*). . . ."
17. "The historical (colonial period to Civil War) uses for turpentine included a host of curative and medicinal applications of unfounded merit. . . ."
18. Turbidimetry and Nephelometry, Vacuum Technique, Viscometry.
19. The long section on Vacuum Technique is unusually complete. Chemical engineers will appreciate its discussion of equipment.
20. None in this particular segment of the alphabet. (See ref. 7.)
21. None in Vol. 14.
22. See *Chem. Eng.*, Mar. 1954, p. 395.
23. Twenty-seven entries.
24. Thiazole Dyes, Thio Acids, and so on through Vitamins.
25. Vitamins: 98 pages; Thia-: 4 lines.
26. "Colored rinses for the hair were originally patterned on the colored rinses commonly used to restore or change the shade of lingerie, curtains or other articles used in the household."

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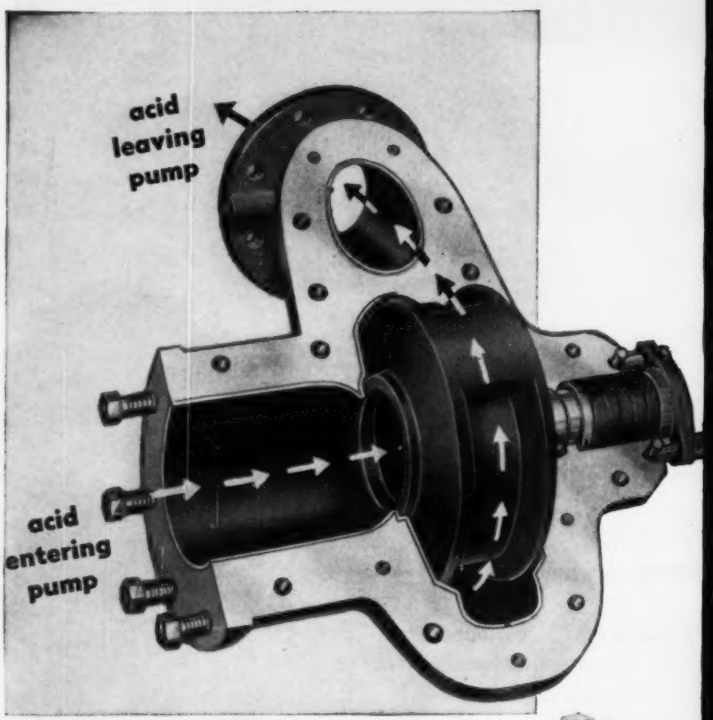


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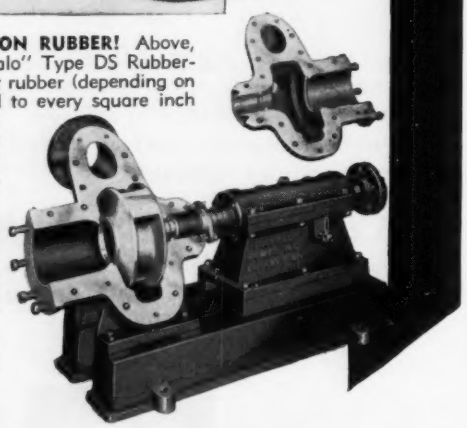

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"One entry[33] deserves special mention.

"Reading or thumbing through this latest volume, one discovers strange facts,[34] learns queer things,[35] is often amused[36] and is frequently impressed with the erudition[37] of the authors. Pedanticism is, of course, at a minimum.

"It is a pleasure to recommend the series as a whole and this volume in particular.—LBP"

---

27. "For this reason, tourists returning to the United States are commonly advised before arrival to obliterate the trade-marks on goods purchased abroad."

28. "Without the convenience of trade-marks, the purchaser might specify siliceous remains of marine plankton diatoms of the Miocene period, milled, calcined with *x* percent of *y* flux at *z* temperature for *a* hours."

29. Six: Thiamin, Thioglycolic Acid, Thiophene, Toluene, Uric Acid, Vanillin.

30. Thermodynamics, Valence, Vapor-Liquid Equilibria and Vapor Pressure.

31. 36¼, 33 and 34½ pages.

32. "Hybridization may occur in elements other than carbon."

33. Unit Operations, by one of the country's oustanding and best-known educators, is much too short.

34. "The mining, possession, sale, and purchase of thorium materials are controlled by the Atomic Energy Commission . . . the largest single commercial use is its utilization as thorium nitrate in making gas mantles."

35. "Sleeping sickness has been a great scourge to the peoples of Africa; however, there have been few reports concerning native treatments other than those involving excision of the cervical lymph modes or incantations . . . one [remedy] consists of the bark of . . . roots, roasted, then beaten with peppers and cockroach dung, the mixture being rubbed into the scalp of the patient."

36. "In two investigations all the authors admitted that they had copied the statement from other publications."

37. "Vinegar eels . . . are nematodes which are usually about ¼ in. long . . . [They] act as scavengers to keep the beechwood shavings free of dead vinegar bacteria and also supply more readily available nutrients to the bacteria."

### Aluminum

DAS CHEMISCHE VERHALTEN VON ALUMINIUM. Aluminium-Verlag, Duesseldorf. 295 pages.

*Reviewed by M. Wulfinghoff*

Designers of process plants frequently need specific data on the performance of available metals in the presence of their given process materials. For aluminum, this carefully coordinated review of the present state of our knowledge on that subject should offer the desired information in the majority of practical applications.

The authors constitute a committee of British, German, French and Swiss experts and researchers. The book's chapters deal with general and specific corrosion information, testing methods and preventive measures; effects of inorganic fluids, metalloids, metals; organic substances—e.g., aliphatic and carbocyclic compounds, heterocyclic compounds; natural products—e.g., foodstuffs, etc. A summary tabulation of important properties is presented on more than 50 pages.

This text will certainly help to define the proper uses of aluminum and its alloys in industry by pointing out where such materials can be employed to advantage and indicating clearly where caution should be exercised. Topography and presentation leave nothing to be desired.

### Heat Transfer

GRUNDGESETZE DER WAERME-UEBERTRAGUNG. By H. Groeber, S. Erk and U. Grigull. Springer, Berlin. 406 pages.

*Reviewed by M. Wulfinghoff*

This is an advanced text, for engineers and physicists, which covers the field of heat transfer in a systematic and rigorous manner. It grew out of Groeber's well known book of 1921 which, in its second edition (1933), had been reworked by Erk. Grigull, in revising and extending the text, has covered those topics which are essential


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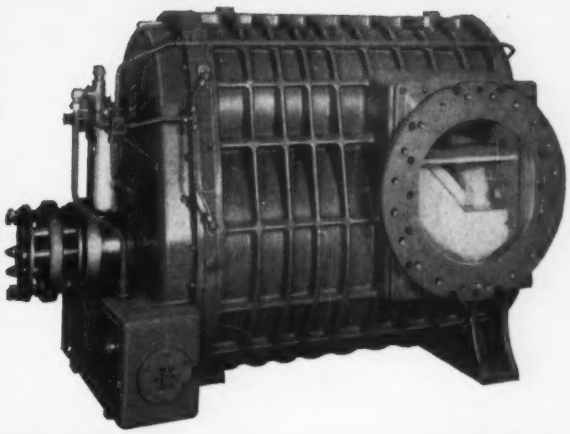

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for an understanding of current trends in research, theory and application.

In the first part, Groeber's treatment of the Fourier equation has been retained. New tables have been added as well as a section on multi-dimensional temperature equalization and discussion of the relaxation method—along with notes on the analog procedure.

Changes in the second part are more radical. The sections on boundary layers, theory of similarity, evaporation and condensation phenomena have been rewritten. There is a section on material transfer reviewing analogies between exchanges of impulses, heat and material and indicating the shortcomings of such methods.

In the third part, results of recent research on absorption coefficients have been included and the section on gas radiation has been reworked. Illustrations and typography are excellent and the indices facilitate orientation.

### Altered Viewpoint

THE CHEMISTRY OF PORTLAND CEMENT. Second edition. By Robert H. Bogue. Reinhold Publishing Corp., New York. 793 pages. $16.50.

*Reviewed by C. L. Mantell*

The author is the director and founder of the Portland Cement Association Fellowship at the National Bureau of Standards, Washington, D. C. During the seven years since the publication of the first edition, the research viewpoint has changed from the investigation of the clinkering characteristics of thousands of different combinations of raw materials, to the exploration of the ultimate molecular and crystallographic structure of the phases that constitute cement and its hydration products. Emphasis is on the research of the structural characteristics of the anhydrous and hydrated cement compounds.

The history, classification, and manufacture of cements are given

briefly as background. This is also the case with the early expe.imentation on the constitution. Then the emphasis changes to methods of investigation, review and new data on the principal constituents of clinker, and the calculation of phase composition. The second part of the volume concerning the equilibria of clinker components emphasizes the high temperature phase research, the techniques, and the fused oxide systems as binaries, ternaries, and quaternaries, as well as those which are more complicated, involving lime, alumina, silica, magnesia, the oxides of iron, titania, phosphorus pentoxide, the alkalis and the sulfates.

The third section of the book deals with the chemistry of cement utilization, again emphasizing the results of the newer investigations employing the newest of research tools in connection with hydration, the structure of hydrated cements, their setting, the hardening, the external reactions.

The volume constitutes a classic which is a "must" for every cement manufacturer, research worker, and investigator in high temperature phase work.

**II and III**

THE CHEMISTRY OF PETROLEUM HYDROCARBONS. Vol. II and III. Edited by Benjamin T. Brooks, Cecil E. Boord, Stewart S. Kurtz, Jr., and Louis Schmerling. Reinhold Publishing Corp., New York. Vol. II, 448 pages, $13.50. Volume III, 690 pages, $18.

*Reviewed by Kenneth A. Kobe*

It is a pleasure to find that Volumes II and III have appeared to complete this set so soon after the publication of the first volume (*Chem. Eng.*, March 1955, p. 326).

Each chapter has been written by an expert in that particular field, or a group of associates in a single laboratory. Usually the authors are in industry with a company known for its developments in the particular field. Occasionally the authors are at a university or a government


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| Micron Diameter | Pure Red Oxide | | Barytes | |
|---|---|---|---|---|
| | Light | Dark | Sparmite | No. 1 Barytes |
| 40 | 100 | 100 | 100 | 99.8 |
| 30 | 100 | 100 | 100 | 99.0 |
| 20 | 100 | 100 | 100 | 88.5 |
| 15 | 100 | 100 | 100 | 73.0 |
| 10 | 99.9 | 99.3 | 97.5 | 57.0 |
| 7.5 | 99.2 | 98.3 | 87.0 | 47.5 |
| 5 | 98.2 | 84.9 | 66.5 | 36.0 |
| 4 | 97.7 | 74.5 | 55.0 | 30.0 |
| 3 | 97.2 | 25.2 | 43.0 | 24.0 |
| 2 | 96.2 | 7.3 | 29.5 | 17.5 |
| 1 | 90.6 | 5.6 | 15.0 | 10.5 |
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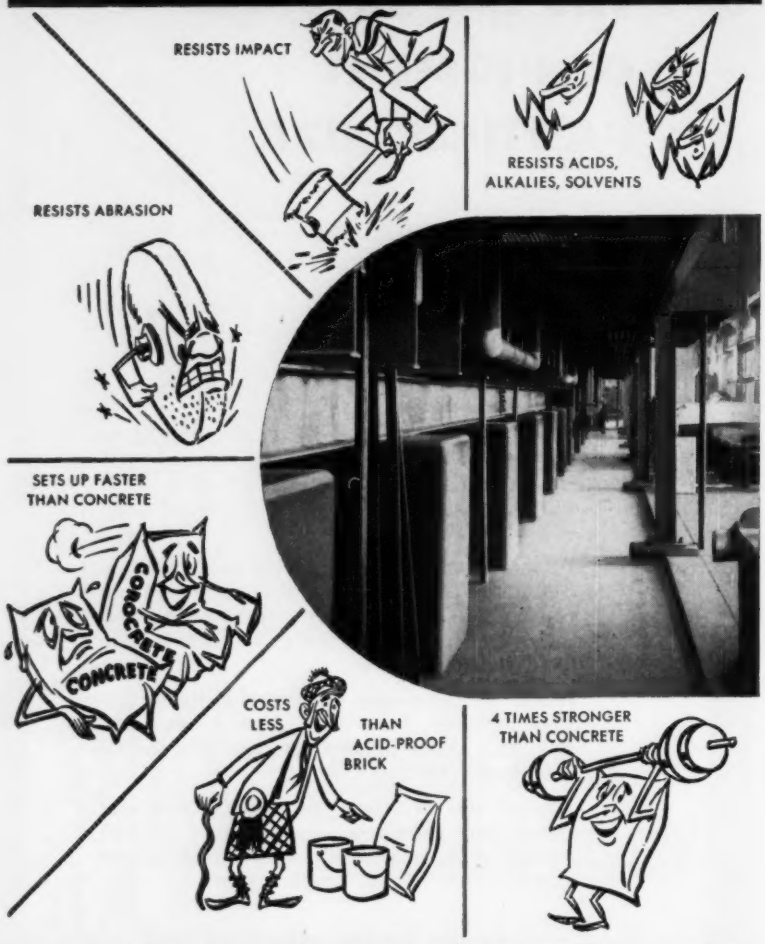


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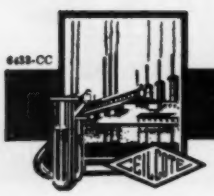


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research laboratory where specialized work has been accomplished.

As with the first volume, the chapters logically fall into sections dealing with closely related topics. Volume I dealt largely with hydrocarbons in natural gas and petroleum, separation, analysis and synthesis of hydrocarbons.

Volume II is concerned with cracking reactions and oxidation of hydrocarbons. An initial chapter discusses mechanisms for the thermal decomposition of hydrocarbons, followed by two chapters on thermal cracking for gasoline and one on acetylene by hydrocarbon pyrolysis. These naturally progress into catalytic cracking—theory and process variables, aromatization reactions and processes, and dehydrogenation. A concluding chapter for these groups presents the carbonium ion mechanism to explain practically all reactions of aliphatic and cycloaliphatic hydrocarbons. The third group of subjects is based on the oxidation of aliphatic hydrocarbons.

Volume III begins with what should have been the last chapter in the second volume, the oxidation of ortho-xylene to phthalic anhydride. A group of five chapters covers certain unit processes for saturated hydrocarbons—isomerization, chlorination, fluorination, nitration, and special reactants. Olefin chemistry is covered by isomerization, vinyl polymerization, polyethylene, Diels-Alder condensations, polymer gasoline, natural and synthetic rubbers (a big field for 20 pages), condensation with saturated halides, alkylation, the Oxo reaction, hydrogenation and many special reactions. The aromatic compounds are not overlooked. A lengthy chapter discusses the theory and mechanism of aromatic substitution, followed by chapters on the unit processes of alkylation, sulfonation, nitration.

There is no cumulative index at the end of Volume III. Some of the chapters published have not been the most important topics in the chemistry of petroleum hydrocarbons, so it might appear that the editors are waiting for some of their slower authors to produce chapters

that can appear in one or more later volumes. Certainly the material now published is sufficiently meritorious to encourage further publication. As stated in the review of Volume I: The set will belong in the library of every engineer and chemist interested in petroleum chemistry or processing.

**Recent Books Received**

*Atomic Energy Research at Harwell.* By E. K. B. Jay. Philosophical Library. $4.75.

*Boundary Layer Theory.* By H. Schlichting. McGraw-Hill. $15.

*Chemical Reactions in Flow Systems.* By S. S. Penner. Interscience. $3.

*Combustion Researches and Reviews 1955.* By B. P. Mullins. Interscience. $5.

*Determination of Organic Structures by Physical Methods.* By E. A. Braude and F. C. Nachod. Academic Press. $15.

*Diesel Engine Principles and Practice.* Edited by C. C. Pounder. Philosophical Library. $17.50.

*Handbook of Hydrocarbons.* By S. W. Ferris. Academic Press.

*Industrial Furnaces.* Vol. 2. 3rd ed. By W. Trinks. Wiley. $10.

*Instruments for Measurement & Control.* By W. G. Holzbock. Reinhold. $10.

*Introduction to Chemical Engineering.* By W. L. Badger and J. T. Banchero. McGraw-Hill. $9.50.

*Introduction to Quantum Statistics.* By W. C. Band. Van Nostrand. $7.50.

*Jet Engine Manual.* By E. Mangham and A. Peace. Philosophical Library. $3.75.

*Metallurgical Progress.* Vol. 2. By J. M. McLeod, D. D. Howat, H. B. Bell. Philosophical Library. $6.

*Microscopy of Ceramics and Cements.* By H. Insley and V. D. Frechette. Academic Press. $7.50.

*Molecular Vibrations.* By E. B. Wilson, Jr., J. C. Decius, P. C. Cross. McGraw-Hill. $8.50.

*Physical Mathematics.* By C. H. Page. Van Nostrand. $7.50.

*Plastics and Building.* By E. F. Mactaggart and H. H. Chambers. Philosophical Library. $12.

*Problems and Control of Air-Pollution.* Edited by F. S. Mallette. Reinhold. $7.50.

*Science Exhibits.* By H. M. Davis. Science Service. $2.

*Selected Combustion Problems.* Edited by W. R. Hawthorne, D. P. Spalding, J. Fabri. Interscience. $8.

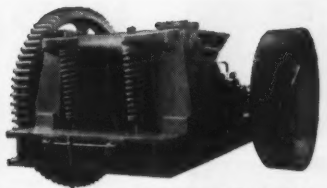
*Spontaneous Ignition of Liquid Fuels.* By B. P. Mullins. Interscience. $2.75.

*Technical Publications.* By C. Baker. Wiley. $6.

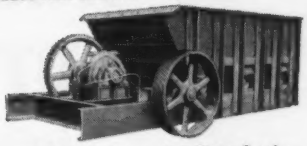
*Ultrasonic Engineering.* By A. E. Crawford. Academic Press. $8.


Specify McLANAHAN EQUIPMENT for dependable low-cost FEEDING, CRUSHING, CLEANING in PITS, MINES and QUARRIES

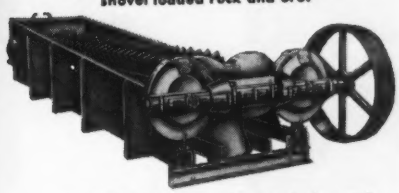
A pioneer in the development of many types of processing equipment, McLanahan has served domestic and foreign pits, mines and quarries for more than a century. Shown are a few illustrations of McLanahan equipment for crushing, washing, sizing and conveying all types of ore, rock, coal and other materials. Technical details and price information will be sent upon request.



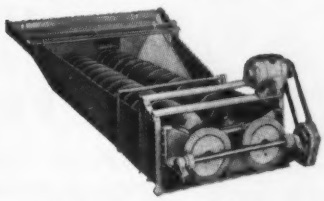
All Steel Rockmaster Single Roll Crusher for primary or secondary work on shovel loaded rock and ore.



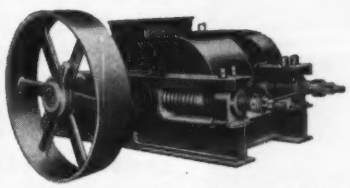
Heavy Duty Reciprocating Plate Feeder. Handles any materials from sand sizes to shovel loaded rock and ore.



Log Washer for removing tough clay and soft rock from various materials.

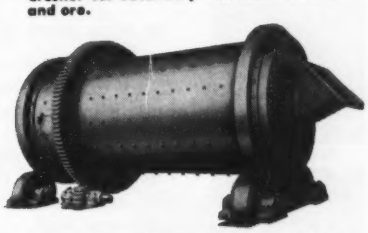


Double Screw Washer (with gear cover removed), for dewatering, classifying and removing waste from sand, limestone and other materials.



Heavy Duty Fabricated Steel Double Roll Crusher for secondary reduction of rock and ore.

Double duty combination Scrubber and Sizing Screen for large and small capacities.



Paddle Mill Scrubbers of various capacities for cleaning large size feed.

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Flat Wire Mesh

Double Intermediate Crimp

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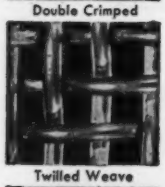
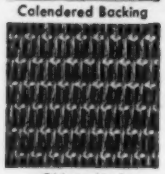
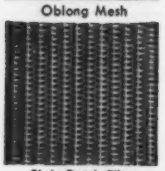
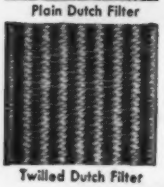
Double Crimped


Twilled Weave

Calendered Backing


Oblong Mesh


Plain Dutch Filter


Twilled Dutch Filter

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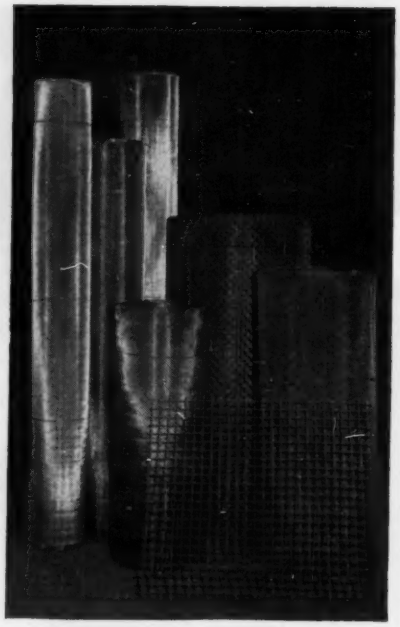

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**CAMBRIDGE ENGINEERS,** in the home office and in the field, are fully qualified to help you select weaves, mesh sizes and metals to meet your needs.

**IF YOU NEED SPECIAL WIRE CLOTH FABRICATIONS—**

Strainers, screens, filter leaves, etc. . . . we can build them quickly and accurately from your prints. . . . or, our engineers will draw up prints for your OK.

**LET US QUOTE** *on your next order for wire cloth in bulk or fabricated wire cloth parts. Call your Cambridge Field Engineer—he's listed under "Wire Cloth" in your classified telephone book.*

**OR, WRITE DIRECT for FREE 80-page CATALOG and stock list giving full range of wire cloth available. Describes fabrication facilities and gives useful metallurgical data.**

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THIS MONTH'S

# *Recent Books*

### Water

Reprints of talks presented at the Fourth Annual Water Symposium held at Louisiana State University in March, 1955. Papers (nine in all) cover: water resources developments by the Corps of Engineers, quality standards for public water supplies, industrial use of ground water in Louisiana, role of surface waters in Louisiana's economy, pollution control practices, water pollution and the sugar industry, salt water disposal in east Texas oil fields, effect of low dissolved oxygen on toxicity of inorganic salts to aquatic organisms, water problems in sulfur mining. 118 pages.

"Proceedings of the Fourth Annual Water Symposium." Bulletin No. 51. Engineering Experiment Station, Louisiana State University, Baton Rouge, La. $1.50.

### Vibration Measurement

A useful guide for understanding and dealing with vibration—both desirable and unwanted. Text includes: (1) meaning of vibration terms; (2) description of vibration-measuring equipment (e.g., meters, analyzers, oscillographs, recorders); (3) applications and use of measuring instruments; (4) examples of typical measurements; (5) interpretation of results; (6) discussion of human response to mechanical vibration. Decibel conversion tables are supplied in an appendix. 60 pages.

"Measurement of Vibration." General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

### Geology

An exhaustive study of the geology of Southern California consists of: (1) A ten-chapter breakdown, in individual booklet form, covering general features, historical geology, geology of the natural provinces, structural features, ge-

## & Pamphlets

omorphology, hydrology, mineralogy and petrology, mineral deposits and mineral industry, oil and gas, engineering aspects of geology; (2) 34 individual map sheets devoted to regional divisions of the area; (3) geologic guides–five booklets each covering a regional division.

"Geology of Southern California." Division of Mines, Ferry Bldg., San Francisco, Calif. $12.

### Minerals

A photographic outline of facilities and equipment with which research in all phases of extractive metallurgy and minerals beneficiation can be conducted. 24 pages.

"Research in Minerals Processing." Battelle Memorial Institute, Columbus, Ohio.

### Texas

A series of 42 maps delineate the distribution in Texas of manufacturing plants and many of the major raw materials used by processing industries. 44 pages.

"Texas Resources and Industries—Selected Maps of Distribution." By Stanley A. Arbingast. Bureau of Business Research, University of Texas, Austin, Tex. $1.

### Super-Strength Alloys

These tables aim at giving an idea of the relative high-temperature strengths of all super-strength alloys known to or used by industry. For each alloy, 100 and 1,000-hr. rupture strengths are given at 1,200, 1,350, 1,500, 1,600 and 1,800 F. 6 pages.

"Compilation of Chemical Compositions and Rupture strengths of Super-Strength Alloys." By W. F. Simmons, V. N. Krivobok, N. L. Mochel and R. Franks. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 75¢.


When **HEAT** or **CORROSION** Add to Your Pressure Piping Problems . . .

Protect Pipe Joints with . . .

**WATSON-STILLMAN FORGED STAINLESS or ALLOY STEEL FITTINGS**

**IN CORROSIVE SERVICE** your pipe joints take a beating–fluid velocity and turbulence accelerate corrosion wherever there is a change in direction of flow.

**AT HIGH TEMPERATURES** structural changes in the metal can cause loss of strength and subsequent failure.

Those are good reasons for "playing it safe" in high pressure service with W-S Forged Stainless or Alloy Steel Pipe Fittings. W-S Stainless Fittings resist corrosion in a wide variety of process liquids and gases and high temperature steam. Available in Types 304, 316 and 304 L.

W-S Alloy Steel Fittings resist oxidation and graphitization and retain their high strength in high pressure–high temperature steam lines. Three alloys available–1¼% Chrome-½% Molybdenum and 2¼% Chrome-1% Molybdenum and 4-6% Chrome-½% Molybdenum.

W-S Forged Stainless and Alloy Steel Fittings can be obtained in Screw-End Type for 2,000 lb., 3,000 lb., and 6,000 lb. WOG service; Socket-Welding Type for Schedules 40, 80, 160 and Double-Extra Heavy Pipe. Send today for bulletin S-1-55.

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# BOARDMAN CAN SUPPLY YOUR PROCESS EQUIPMENT

For more than 43 years, BOARDMAN's competent staff of skilled engineers and hundreds of expert metalcrafters have served the metal fabricating needs of the process industries.

During these four decades, BOARDMAN has developed a remarkable versatility. From complete carbon-black plants to steel conveyor boxes, BOARDMAN manufactures dependable metal products for practically every industrial use.

Even within a single product category, BOARDMAN designs, engineers and fabricates to specific needs. In conveyor systems, for example, BOARDMAN offers stainless steel or rubber-faced steel plate . . . screw, belt or paddle conveyors . . . standard or steam-jacketed . . . porcelain and other special liners . . . formed or angle iron tops . . . steel flanges or butt strap joints . . . slip-on, bolted, spring clip or weatherproof covers . . . and any other custom specification you may require.

**OUR CHALLENGE TO YOU—**

Let our Chief Engineer fly to your plant for on-the-spot consultation about your special metal fabrication requirements. We also invite your inspection of our 7-acre plant facilities at any time. Write, wire or telephone TODAY—for literature, quotations or immediate action.

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PRESSURE VESSELS INCLUDING A.S.M.E. CODE VESSELS • BATCHERS • BINS • BURNERS COLLECTORS • CONVEYORS • DRYERS • DUCTS • ELEVATORS • FANS • FEEDERS • FLUES GRADING EQUIPMENT • HOPPERS • MIXERS • STACKS • STERILIZERS • TANKS • WASHERS


THIS MONTH'S

## Firms in

### New Lines

**Frontier Chemical Co.**, Wichita, Kans., has just completed facilities which will add chlorinated solvents to its existing line of chlorine, caustic and other chemicals.

**Koppers Co.**, Pittsburgh, now has a line of bag-type filters as a result of the acquisition of Turner & Haws Engineering Co., West Roxbury, Mass.

### New Companies

**Engineering Design and Development Co.**, New York, has been formed to do design, consulting and construction work on chemical metallurgical plants.

**Prairie Pipe Co.**, Ltd., Regina, Saskatchewan, has been established to make steel pipe for oil and gas industries.

**Chagrin Chemicals, Inc.**, Chagrin Falls, Ohio, has been formed to service industrial equipment by removing scale deposits with chemicals.

**Trand Plastics Co.**, Norwalk, Conn., has been formed to extrude and process thermoplastic sheet.

### New Locations

**Information for Industry, Inc.**, publishers of the Uniterm Index to Chemical Patents has moved to larger quarters at 1108 16th St., N.W., Washington, D. C.

**O. C. Keckley Co.**, manufacturer of steam and liquid control equipment, has combined its administrative and manufacturing operations at a new location at 3400 Cleveland St., Skokie, Ill.

**Consolidated Chemical Industries Inc.**, New York, will move its

## the News

M. A. Gibbons

Houston research laboratory to new quarters in Peiser Park early in 1956.

**United States Rubber Co.** has moved its plastics molding operations from Chicago to Fort Wayne, Ind.

**Metrotype Corp.**, manufacturer of digital recording systems, has moved to Michigan City, Ind.

**Sensitive Research Instrument Corp.** has relocated at 310 Main St., New Rochelle, N. Y.

### New Names

**Glidden Co.**, Cleveland, Ohio., has changed the name of its naval stores division to southern chemical division because the company has added derivatives to its production of basic naval stores.

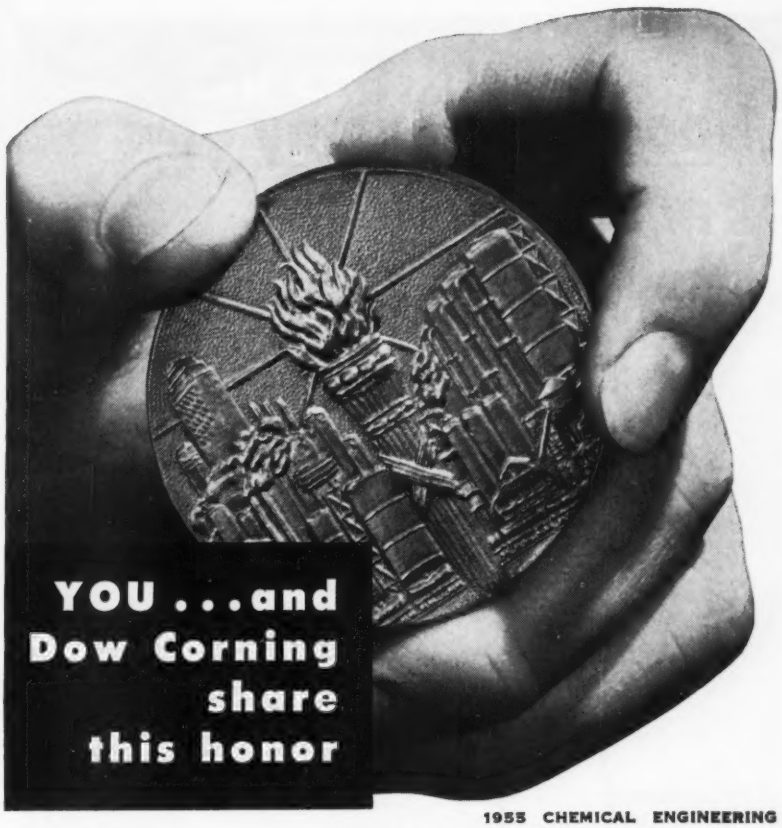
**Winthrop-Stearns Inc.**, New York, has changed its name to Winthrop Laboratories, Inc.

### New Representatives

**Ohio Brass Co.**, Mansfield, Ohio, has appointed the following new valve sales representatives: C. S. Bigelow & Associates, Los Angeles, to cover California and southern Nevada; Associated Valve & Engineering Co., San Francisco, to cover the San Francisco and Reno areas.

**Dean Products, Inc.**, Brooklyn, N. Y., has appointed Montanye Engineering Sales, Salt Lake City, to represent its Thermo-Panel Div. in eastern Nevada and southern Idaho.

**A. W. Cash Co.**, Decatur, Ill., has appointed three new agents for its line of automatic valves, controllers, governors and regulators: I. W. Cotton Co., Indianapolis, covering central and southern Indiana; Fuel


1955 CHEMICAL ENGINEERING ACHIEVEMENT AWARD*

**because you are always looking for ways to make new and better products.** By inventing new and better machines that operate at temperatures beyond the limits of conventional materials, you created a rapidly growing need for our silicone fluids, greases, compounds, resins and rubber with their extraordinary indifference to time, temperature and weather.

**because you are constantly working to reduce maintenance and production costs.** In your own factories and locomotives you helped us to prove that silicone insulated motors outlast the next best class of motors 10 to 1. You also used our silicone lubricants to get more continuous production and reduce maintenance costs. You worked with our engineers to establish the many advantages of our silicone release agents in molding rubber and plastics, casting metals and baking bread.

**and because everyone wants more comfort and protection.** We invested years of research and development work to create silicone finishes for fabric and Sylflex† for use in tanning leather. These silicone products make your clothing, shoes and upholstered furniture shed water and water borne stains, feel better and stay new looking longer with less care.

†T.M. REG. U.S. PAT. OFF.

*

*Presented every second year since 1933 by Chemical Engineering magazine to the company or the industry that has, in the opinion of the nation's leading educators in the field of chemical engineering, contributed the most to the advancement of chemical engineering in industry.*

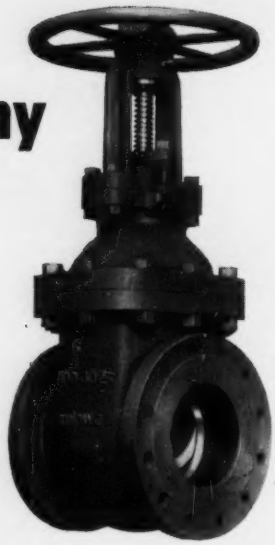
***for a copy of "What's a Silicone?" and a Reference Guide to Dow Corning Silicone Products, please address Dept. 2612-B.***

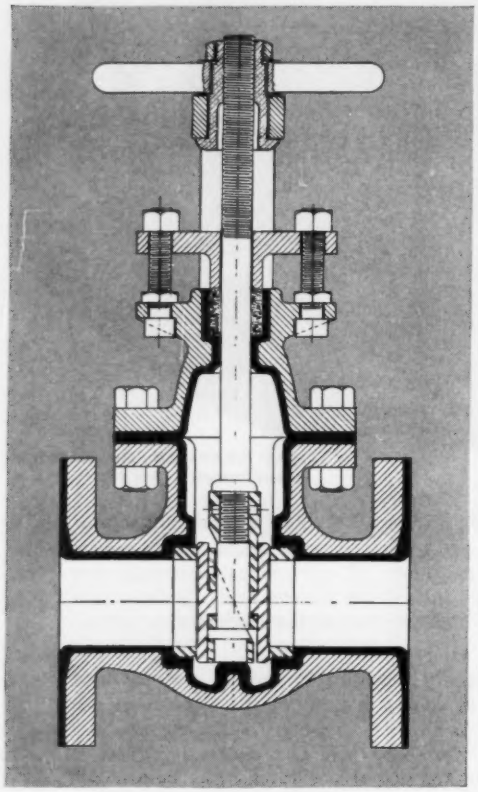
first in silicones

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA CHICAGO CLEVELAND DALLAS DETROIT LOS ANGELES NEW YORK WASHINGTON, D.C.
CANADA: DOW CORNING SILICONES LTD., TORONTO GREAT BRITAIN: MIDLAND SILICONES LTD., LONDON FRANCE: ST. GOBAIN, PARIS

# FOR double economy in corrosive service





● *Darling rubber-lined iron body gate valves, with special alloy working parts, offer trouble-free corrosive service and big savings. Available in rising stem, cylinder or motor operated, or quick-opening types.*

HERE'S a Darling gate valve that can save you plenty of dollars in corrosive services up to 180° F. This is an iron body valve with a hard rubber lining permanently bonded to all exposed interior surfaces, and suitable for working pressures up to 150 pounds.

Equally important, this valve features Darling's *fully revolving double disc parallel seat principle* which is unexcelled for trouble-free performance, tight closure, low maintenance and long life.

Weigh these facts and potential savings, then write for complete data on these job-proved rubber-lined iron body valves.

**DARLING VALVE & MANUFACTURING CO.**
**Williamsport 3, Pa.**
*Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.*

**FIRMS . . .**

Economy Engineering Co., St. Paul, covering Minnesota, North Dakota, South Dakota and northwest Wisconsin; Keener Sales Co., Knoxville, covering Tennessee.

**Brown Fintube Co.,** Elyria, Ohio, has appointed Western Supply Co., Tulsa, Okla., as sales representative in Kansas, Oklahoma and Kansas City, Mo.

**American Agile Corp.,** Cleveland manufacturer of polyethylene parts, has appointed Hamilton Associates, Indianapolis, as sales representative covering Indiana and northern Kentucky.

**Edward Valves, Inc.,** East Chicago, Ind., has appointed Rotary Sales and Service Ltd., Edmonton, as its representative in the Alberta and Saskatchewan areas.

**Northwest Nitro-Chemicals, Ltd.** has appointed Harrisons and Crosfield Ltd. as exclusive sales agents for chemical fertilizers from its $22 million plant at Medicine Hat, Alta., now under construction.

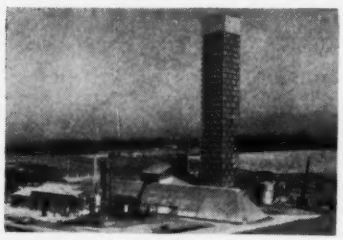
**Chase Chemical Corp.,** Pittsburgh manufacturer of paint driers and fungicides, has appointed H. D. Thornley Co. its exclusive sales representative in Philadelphia, Baltimore, Wilmington, Trenton and Camden.

**New Facilities**

**Crown Zellerbach Corp.** has acquired Gaylord Container Corp. through an exchange of stock. Crown Zellerbach is also negotiating the sale of its interest in Fibreboard Products Inc. to Pabco Products Inc. The West Coast paper manufacturer has just opened a $600,000 central research laboratory at Camas, Wash.

**Carbide and Carbon Chemicals Co.** has started producing sorbic acid for food use in a new 1 million/lb./yr. unit in South

Charleston, W. Va. The company has also started construction, to be completed late in 1956, of a new ethanolamines unit at Seadrift, Tex., which will more than double its production capacity. Another new Carbide facility: a new New Orleans sales office.



**Brea Chemicals, Inc.,** Los Angeles, has started production at its 50,000 tons/yr. prilled ammonium nitrate plant near Brea, Calif. The plant's 200-ft. prilling tower, above, is the tallest all-aluminum process structure in the world.

**Colgate-Palmolive Co.** plans a $5 million central research laboratory in Bloomfield, N. J., to be completed in 1957.

**Babcock & Wilcox Co.,** New York, has asked the AEC for licenses to fabricate nuclear elements that provide fuel for atomic reactors.

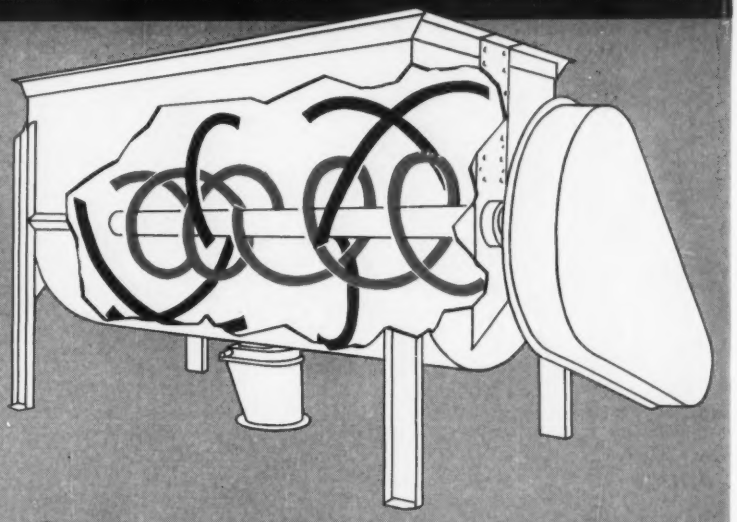
**U.S. Industrial Chemicals Co.,** division of National Distillers Products Corp. has completed a $500,000 pilot plant in Cincinnati. First product to be piloted will be isosebacic acid.

**W. M. Barnes Co.** has reached an agreement to reactivate the new $1 million Sure-Seal Corp. wax refinery at North Salt Lake City, Utah. Sure-Seal has been in hands of receivers.

**Bemis Bro. Bag Co.,** St. Louis, has acquired new Terre Haute, Ind., headquarters for its subsidiary, Flexible Package Co., now located in Chicago.

**Ladish Co.,** Cudahey, Wis., manufacturer of drop forgings, pipe


FOR CONTINUOUS
OR BATCH OPERATIONS



Readco counterflow action

assures rapid, thorough mixing or blending of pulverized or granular, wet or dry materials.

Heavy-duty construction stands up under long runs and adverse processing conditions with a minimum of costly downtime.

Readco Spiral Ribbon Mixers can be supplied for atmospheric, elevated pressure or vacuum operation . . . with or without temperature controlling jackets. Working capacities up to 500 cubic feet.

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York, Pennsylvania

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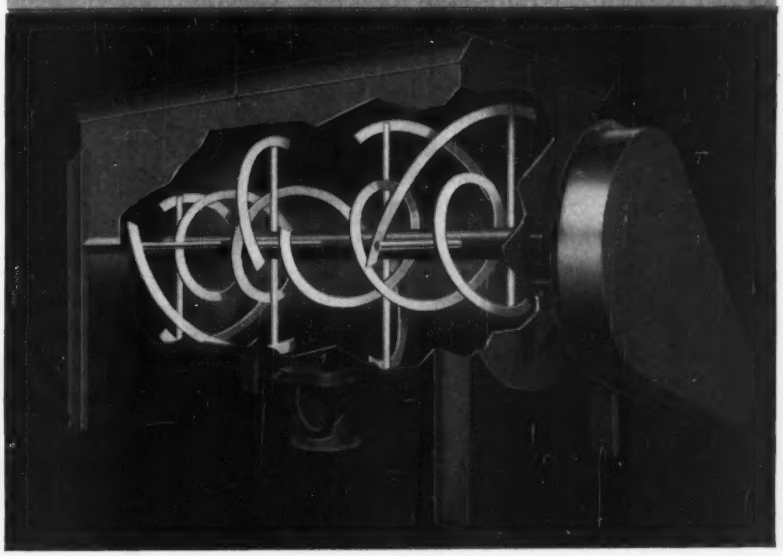
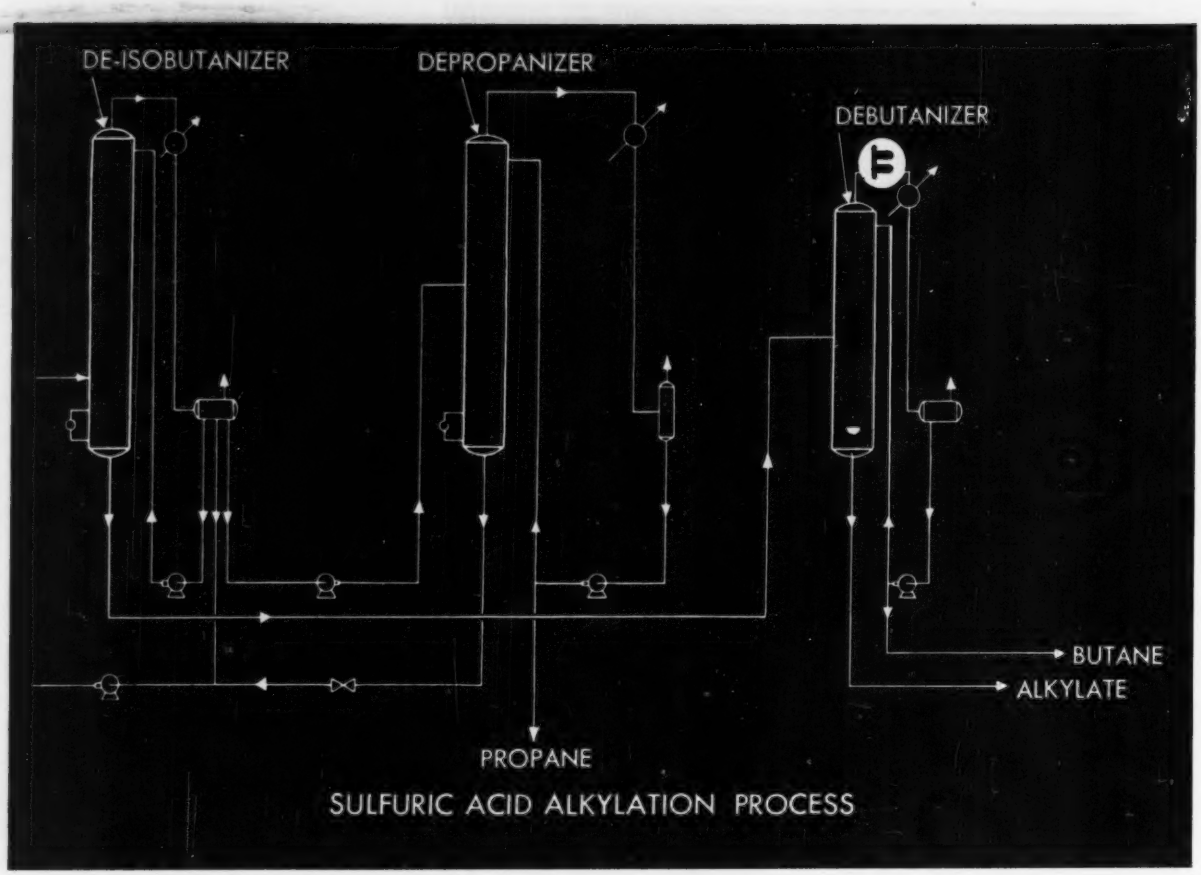
CORPORATION






*Cut isobutane loss in debutanizer overhead . . .*

# SAVE THOUSANDS OF DOLLARS YEARLY IN ALKYLATION UNITS *with Continuous Analyzers . . .*

**P-E TRI-NON* Infrared Analyzers** can increase alkylation unit profits by reducing loss of valuable isobutane in spent butane streams. The isobutane savings per analyzer are on the order of $20-$60,000 per year depending upon through-put. Continuous analyses also increase profits by eliminating labor required for periodic sample testing.

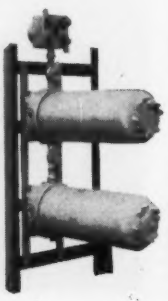
An analyzer sensitized to isobutane, at the debutanizer overhead, provides information to the operator with which he can control either the butylene-isobutane feed ratio, or deisobutanizer operating conditions. "Analytical lag" is eliminated by moving the laboratory right onto the process line.

P-E instruments can analyze and control to ± 1%. They need no special housing, require no complicated automatic standardization. They provide the best zero and range stability available.

When you specify continuous analyzers for your process streams, only P-E has a complete line of instruments to choose from. Or let us develop a complete analytical control system for you. Nowhere else can you get the combination of chemical engineering and instrument know-how that you'll find at P-E.

*T. M.

**Perkin-Elmer**
**CORPORATION**
**Norwalk, Connecticut**



**P-E TRI-NON Analyzers** are available in a wide range of models and prices to meet all types of continuous analytical problems. They are rugged and dependable, expressly designed for use in the varied environments of a processing plant or refinery. For quick and easy maintenance, instrument components can be tested right on stream — without disconnecting.

fittings and rolled rings has purchased two adjacent Los Angeles plants: CBS Steel and Forge Co. and General Pacific Corp.

**Chas. Pfizer & Co.** has opened a new southwestern distribution center in Dallas, Tex., to serve a seven-state area.

**American Potash & Chemical Corp.** has announced a 20% increase in natural sodium sulfate production at its main plant at Trona, Calif.

**Stauffer Chemical Co.** has acquired Consolidated Chemical Industries, Inc., which will operate as a Stauffer division.

**Hooker Electrochemical Co.,** Niagara Falls, has acquired the Niagara Alkali Co.

**Catalin Corp, of America** and **Reichhold Chemicals, Inc.,** are negotiating to merge into a firm to be called Reichhold Catalin Chemicals, Inc.

**Borg-Warner Corp.** is building a large research center at Des Plaines, Ill.

**Standard Oil Co. of New Jersey** has placed all phases of its worldwide petrochemical operations under central coordination.

**Polychemical Industries, Ltd.** will build a 588,000 lb./yr., $225,000 polychemical plant at Edmonton, Alta.

**Pennsylvania Salt Mfg. Co.** is finishing construction of its first potassium hydroxide unit at its Calvert City, Ky., works.

**United States Gypsum Co.** has increased production of high purity industrial lime at its New Braunfels, Tex., plant by more than 60% through the installation of new facilities.

**Food Machinery and Chemical Corp.** is modernizing chlorine production facilities at the South

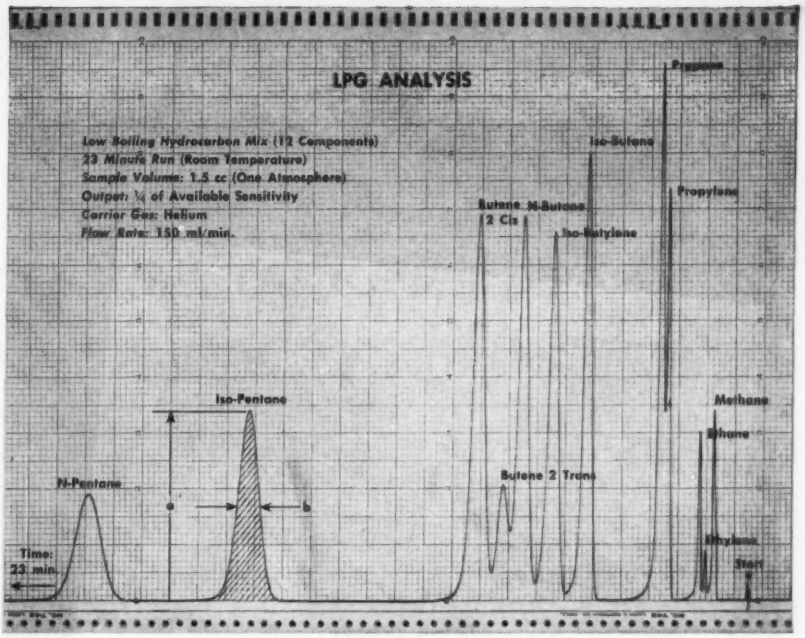




Photo of actual run made on new P-E Vapor Fractometer. To find mole % concentration of a component, analyst simply integrates area under peak by multiplying peak height (a) times half-band width (b).

*This quantitative analysis took only 23 minutes on the new P-E Vapor Fractometer that costs only $1,375*

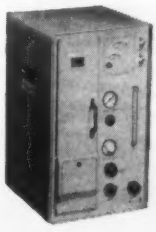
## HOW LONG WOULD IT TAKE YOU?

Employing the principles of gas chromatography, P-E's new vapor fractometer is a revolutionary advance in the field of gas and volatile-liquid quantitative analysis. It is fast, precise, uncomplicated to operate, extremely simple in calculation, and above all, many times less expensive than distillation columns, mass spectrometer, or any other instrument, for the purpose.

For qualitative analysis, the instrument gives extremely clean separations—even of components and isomers which cannot be separated by ordinary methods. For trace analysis, high sensitivity permits use of extremely small samples.

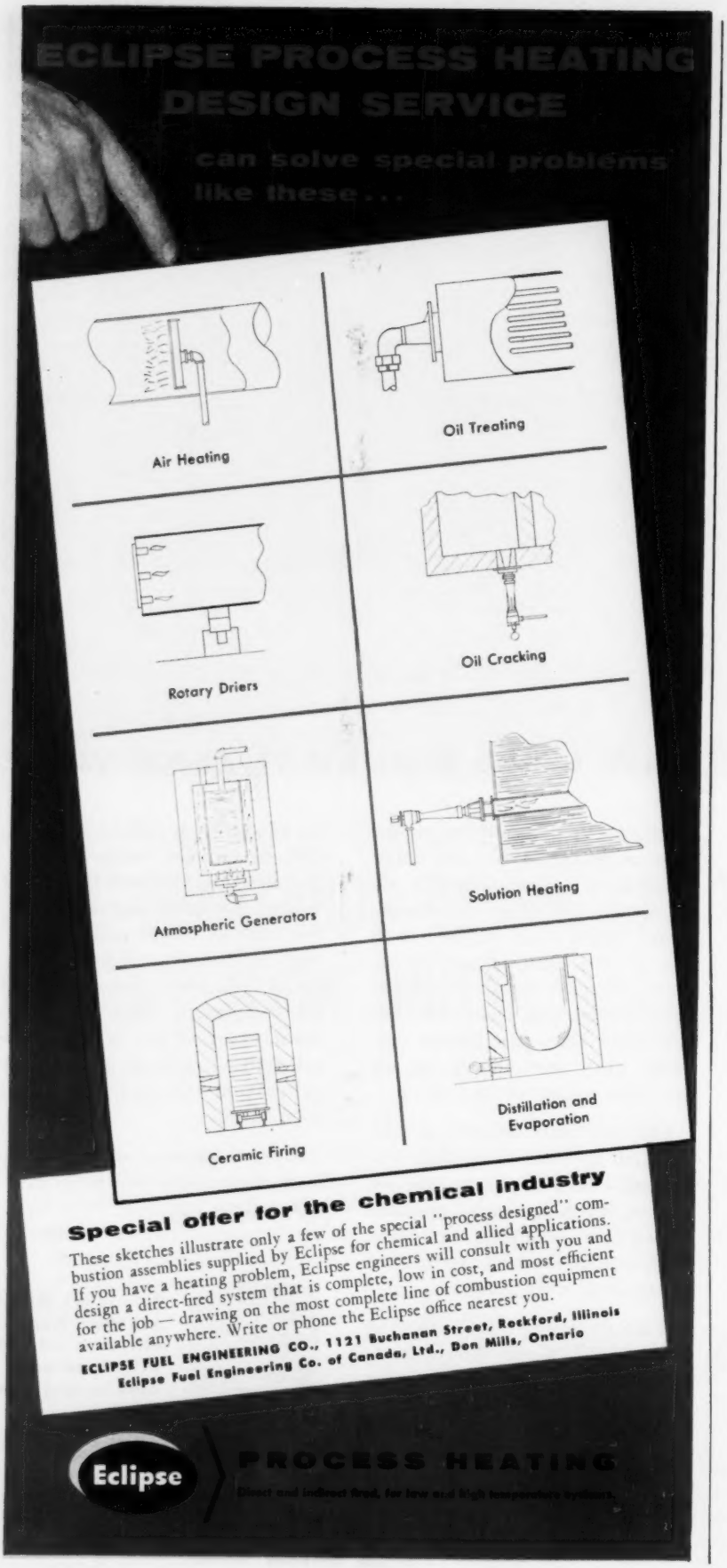
Take, for example, the analysis of a synthetic LPG mix shown above. Here 12 components, representing the hydrocarbons most frequently encountered, were clearly separated—a job extremely difficult to accomplish by ordinary vacuum distillation methods. The perfect shape of the recorder bands makes quantitative analysis simple and accurate. Area under each peak is the measure of the mole % concentration of the component. These area relationships are all that is needed for calculation, without preliminary calibration for each individual component.

There is no faster, no simpler, no more inexpensive method in existence today.



**This is the Model 154 Vapor Fractometer**—price, $1375.00 without recorder. Send for descriptive bulletin.

**Perkin-Elmer** CORPORATION
Norwalk, Connecticut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These sketches illustrate only a few of the special "process designed" combustion assemblies supplied by Eclipse for chemical and allied applications. If you have a heating problem, Eclipse engineers will consult with you and design a direct-fired system that is complete, low in cost, and most efficient for the job — drawing on the most complete line of combustion equipment available anywhere. Write or phone the Eclipse office nearest you.
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PROCESS HEATING


**FIRMS . . .**

Charleston, W. Va., plant of its Westvaco chlor-alkali division. The company has also started construction on a central research laboratory in the Princeton, N. J., area.

**United States Rubber Co.,** New York, has just opened a new latex processing plant in Gastonia, N. C.

**Permanente Cement Co.** is building a $12 million, 2 million-bbl.-yr. cement plant in San Bernardino County, Calif.

**Owens-Corning Fiberglas Corp.,** Toledo, will finish construction next fall on a plant near Camden, N. J., to manufacture Fiberglas insulations, noise control products and other building materials.

**Richmond Exploration Co.,** subsidiary of Standard Oil Co. of California, will build a $4 million, 10,000 bbl./day asphalt refinery at Maracaibo, Venezuela.

**Gulton Mfg. Corp.,** Metuchen, N. J., has formed a new scientific group devoted to the research and development of instruments in the field of nuclear energy.

**The Fluor Corp., Ltd.,** Los Angeles, has combined its engineering and construction operations into one division.

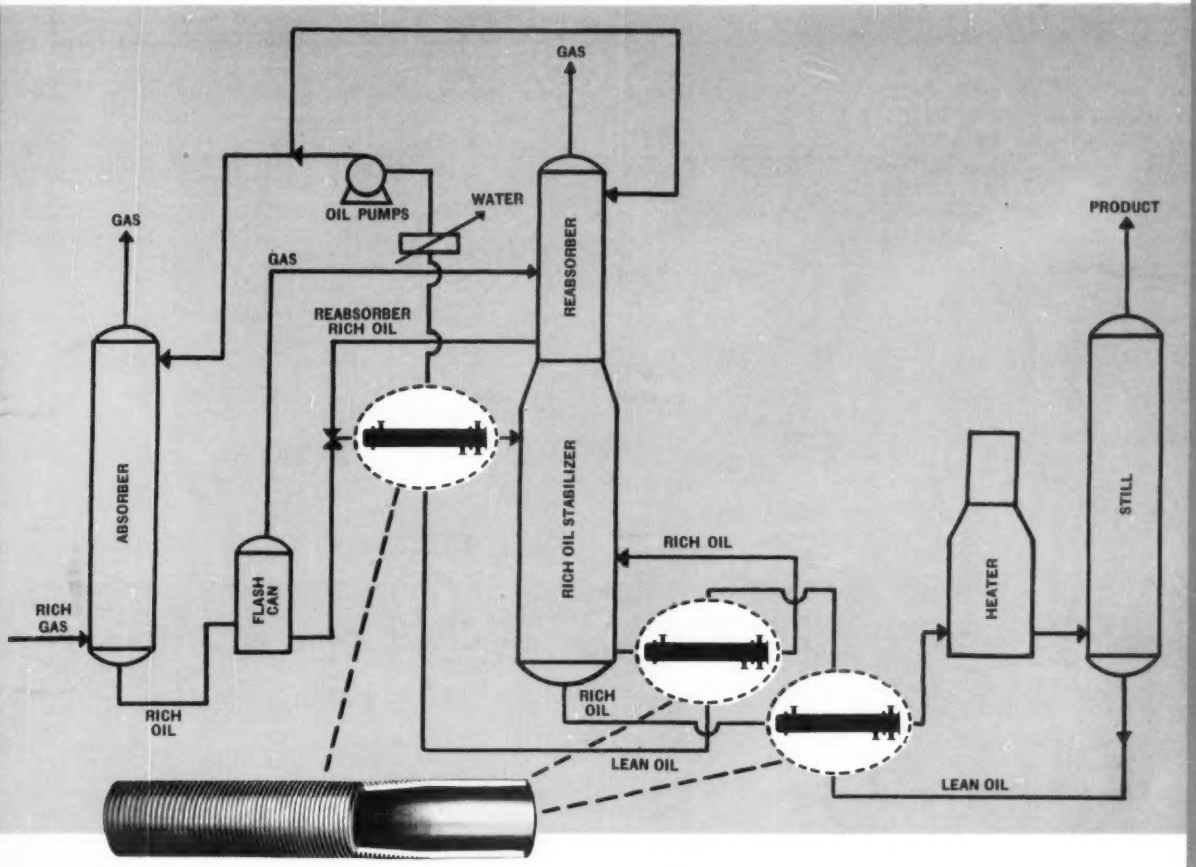
**Alunite Corp. of America** will build a $20,000, 25-ton-a-day mill and storage facility at Marysvale, Utah.

**Hinde & Dauch Paper Co.,** subsidiary of West Virginia Pulp & Paper Co., plans to build a $2.5 million factory for corrugated boxes at Eaton, Ohio.

**Socony Mobil Oil Co.,** New York, is spending $600,000 to double the space available for analytical operations in Paulsboro, N. J. A catalytic reforming unit for upgrading motor oil will be com-

*Real opportunities in heat exchange—*
*Number 12 of a series.*

# *How One Southwest Processor Obtained Increased Efficiency in Lean Oil—Rich Oil Exchangers*




## HEAT EXCHANGERS TUBED *with Wolverine Trufin* Type S/T*

The light hydrocarbon recovery system charted above shows where Wolverine Trufin Type S/T condenser tubing was used effectively in lean oil—rich oil heat exchangers.

Trufin was specified by this processor when he found that it would help him transfer more BTU's per foot of tube—give him more capacity, using smaller units, than he could obtain with exchangers containing prime surface condenser tube.

Because Trufin is a *finned condenser tube,* there is more surface area available for heat transfer. Wolverine Trufin has *integral construction*—the fins are squeezed right from the tube wall—it has the stamina to stand up under rugged operating conditions.

Yes, you can cash in on these benefits, too. *Opportunity* is spelled out in a Wolverine technical book entitled just that. Write for your copy, today.

WOLVERINE TUBE, 1443 Central Avenue, Detroit 9, Michigan.

*REGISTERED U.S. PATENT OFFICE

**WOLVERINE TUBE**

**Division of Calumet & Hecla, Inc.**

MANUFACTURERS OF QUALITY-CONTROLLED TUBING AND EXTRUDED ALUMINUM SHAPES

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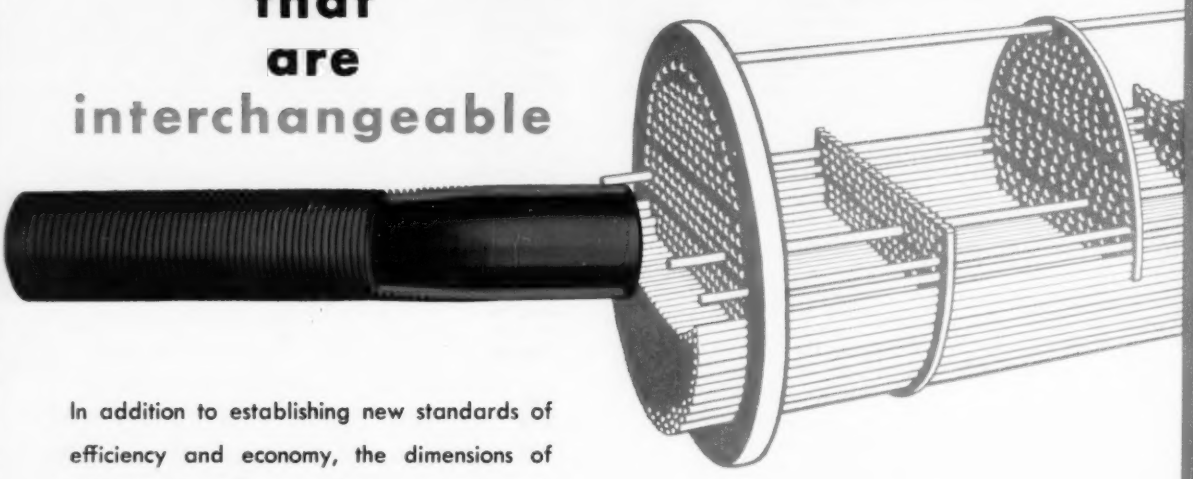
# CONDENSER TUBES

## that are interchangeable



In addition to establishing new standards of efficiency and economy, the dimensions of Wolverine Trufin* Type S/T are such that it is completely interchangeable with prime surface tubing.

You can boost the capacity of existing units by *directly substituting* Trufin Type S/T for plain condenser tube. Type S/T is specifically designed for shell and tube heat exchangers. Being completely INTERCHANGEABLE—it can be rolled into tube sheets as easily as plain tube—using the same fabrication methods and the same tools.

Standard retubing procedures are used with Trufin Type S/T because the outside diameter of the finned section is no greater than the outside diameter of the plain end which is rolled into the tube sheet. As an additional design advantage, the wall at the plain end section is approximately two gauges heavier than the specified tube gauge. This affords a better bond at the tube sheet and provides additional protection against inlet erosion.

Because of Trufin Type S/T, you can now reap the benefits of extended surface condenser tube in existing equipment. Remember—Type S/T is INTERCHANGEABLE—specify it next time you retube. Write for the Trufin Opportunity Book. It will guide you to new heat transfer economy.

**PRIME SURFACE TUBE**

**Remember, too, that Wolverine is a leading manufacturer of prime surface condenser tube. Wolverine customers can specify exactly the tube they need from a wide range of sizes and alloys in copper, aluminum and electric-welded steel.**

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**Division of Calumet & Hecla, Inc.**

MANUFACTURERS OF QUALITY-CONTROLLED TUBING AND EXTRUDED ALUMINUM SHAPES

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Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

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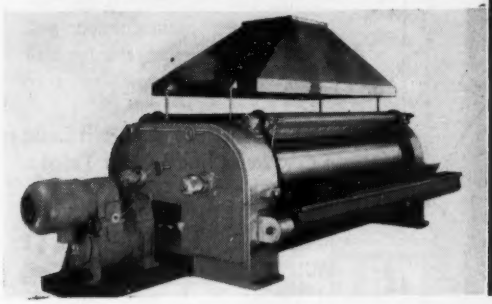
## 42" Diameter x 120" Long "DAVENPORT" ATMOSPHERIC Double Drum DRYER



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Continuous DeWatering Presses

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Atmospheric DRUM DRYERS

ROTARY COOLERS Water and Air

Permits the continuous drying of many products from slurry stage into dried product.

The process of drying is accomplished by applying the liquid material in a thin film to the revolving, steam heated drums, on which the moisture is evaporated during a partial revolution. The dried material is removed from the drums by so-called doctor blades or knives.

**Let our engineers consult with you on your Pressing, Drying, and Cooling problems. Send for complete Catalog A, or, for quick reference, consult your CHEMICAL ENGINEERING CATALOG.**

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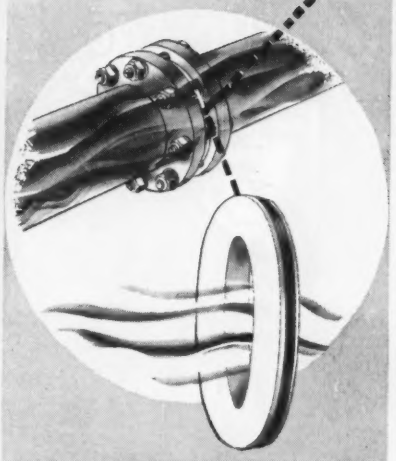
# *Unimpeded Flow*



CHEMPRO's Style 50 Machined Teflon* Jacketed Gaskets allow unimpeded flow of either liquids or gases. The machined Teflon jacket I.D. fits flush with the flange I.D. Ideal for equipment, valve and piping systems where corrosion resistance and non-contamination of liquid or gas are also required.

By varying the combination of filler materials, the Chempro Style 50 gasket can be made with compression characteristics to meet your specific operating conditions. Fill materials include neoprene, rubber, compressed asbestos, and woven asbestos cloth.

**Ordering Information Required**

1. Inside and outside diameters.
2. Flange or nozzle material.
3. Operating pressure and temperature of liquid or gas.
4. Equipment make, model and size.

*Complete information on Style 50 gaskets is given in Bulletin CP553, Section B.*

*THE ORIGINAL FABRICATORS OF TEFLON PACKINGS AND GASKETS*

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This is an insulated steam separator on a turbine driving an airblower.

***EFFICIENT EXTRACTION OF LIQUID MIST FROM GAS, STEAM OR AIR***

The HIGH CAPACITY, HIGH EFFICIENCY and LOW PRESSURE DROP of Peerless Line Separators makes them popular in Refineries and Chemical plants throughout the world for the extraction of liquid from gas, steam or air.

The Peerless Principle of mist extraction combines the forces of impingement, centrifugal motion and surface tension to obtain its high degree of efficiency. Through the Peerless method, the entrained droplets are caused to roll down the vanes and out of the gas stream, therefore the gas is STRIPPED DRY LONG BEFORE reaching the end of the vanes.

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**FIRMS . . .**

pleted in Buffalo, N. Y., by mid-1956. Capacity: 9,000 bbl. per stream day. In St. Paul, Minn., the company is increasing storage, maintenence and pipeline facilities to the tune of $720,000.

**L.O.F. Glass Fibers Co.** will build a new research center in Toledo, Ohio.

**Schering Corp.** will complete a $1 million sterile products building at Union, N. J., next spring.

**Blaw-Knox Co.,** Pittsburgh, has offered to buy assets and business of Continental Foundry & Machine Co., East Chicago, Ind., for about $25 million.

**Kennecott Copper Corp.,** New York, has obtained a 52% interest in Tin and Associated Minerals, Ltd. located in West Africa in the highlands of Nigeria.

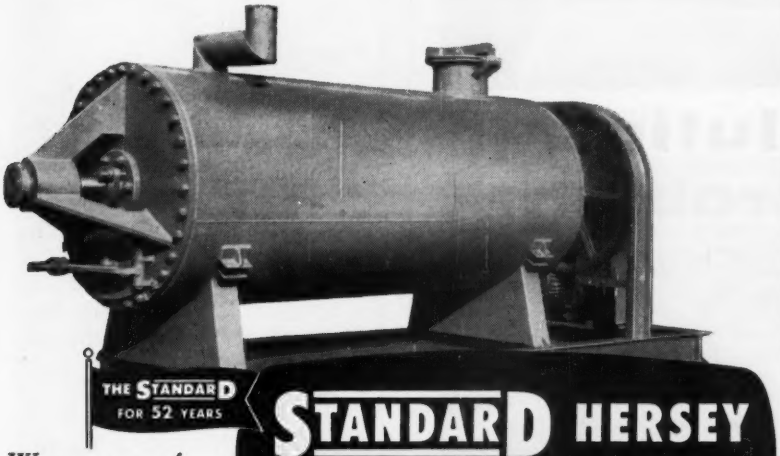
**Edwards & Co.,** Sussex, England, is negotiating for a license to manufacture industrial Cartesian manostats developed by the Manostat Corp. of New York.

**Imperial Oil, Ltd.** will construct a new catalytic reformer at Sarnia, Ont. which will absorb part of $5 million the company is spending on new equipment.

**Hagan Corp.,** Pittsburgh, will complete a $1 million chemical processing plant at Rockwood, Mich., in the fall of 1956.

**Penn-Dixie Cement Corp.** has begun a $4.5 million expansion program at its West Des Moines, Iowa plant which will raise annual capacity to 2.3 million from 1.4 million bbl.

**Celanese Corp. of America** is establishing complete development laboratories in Charlotte, N. C., for its textile industry marketing operation. Chemical division of the company has recently opened a push-button storage terminal at Newark, N.



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In the closed position the piston or ram extends up into the tank, preventing plugging of the outlet.

In the open position with piston fully retracted, there is no resistance to flow of materials drained from the tank.

Made in any cast metal to meet your requirements.

Designed for bolting to existing flanges. For special adaptations and for jacketed vessels, adaptor pads are available.

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If you process granular materials that must be uniform in length, width, or thickness, Hart-Carter sizing machinery may be what you need.

Hart-Carter makes several types of equipment that accurately sizes or separates by means of pocketed Carter discs or indented Hart cylinders . . . or by cylinders perforated with either slots or recessed round holes. These principles and methods are described in folders CPG-2 and L-1, which we'll be glad to send to you.

Information you supply our technicians about the in-put materials to be sized, and the "product" specifications, will enable them to make sound recommendations. (Such information will be kept confidential, of course.) Tests in the Hart-Carter Laboratory are free.

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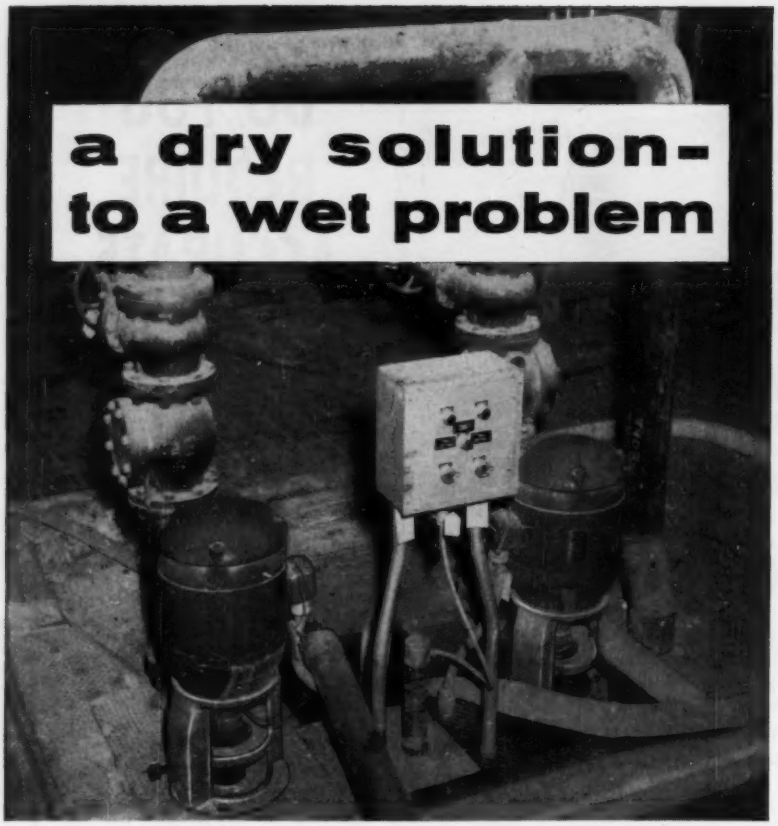


A large-volume user of water had a "wet plant problem." The solution is pictured above. Here you see two Deming Vertical Sump Pumps each with a 10 HP motor. Each pump has a rated capacity of 500 GPM with a 50-foot head. Unwanted water from all areas of the plant drains into a pit. When water in the pit rises to a predetermined level, one of the Deming Sump Pumps goes into action automatically. Or, if required, both pumps can be used simultaneously. If you have a "wet plant problem" there's a Deming Distributor near you to help you solve it.

**DUPLEX UNITS**

Where conditions require two pumps to operate separately, in sequence, or simultaneously, Deming Vertical Sump Pumps can be furnished as Duplex Units. The complete line includes a wide range of single and duplex units to meet most sump pump requirements. Write for illustrated BULLETIN 4600-A.

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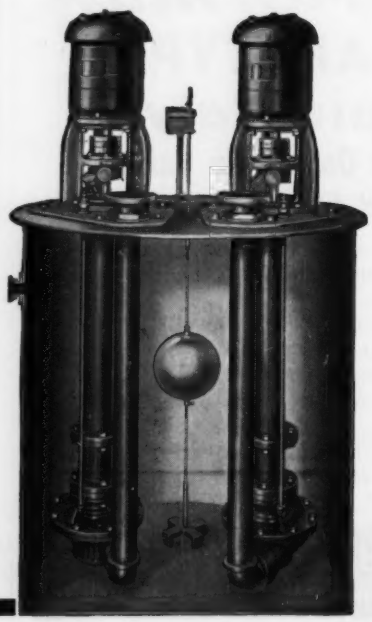



**FIRMS . . .**

J., with capacities of 4 million gal of liquid chemicals, 1 million lb. of dry products and a substantial drumming capacity.

**General Petroleum Corp.,** with work nearing completion on a $1.4 million expansion of its Ferndale, Wash., refinery, has announced plans to spend an additional $3.6 million next year.

**International Minerals & Chemical Corp.** has begun construction of a $400,000, 100-ton-a-day mica plant at Greenville, Tenn.

**Texas Eastman Co.,** division of Eastman Kodak Co., Longview, Tex., has started production at its new octyl alcohol plant.

**Witco Chemical Co.** has started operations at a new metallic stearates plant at Los Angeles, Calif.

**Chemstrand Corp.** has just formed a British subsidiary and expects to manufacture its acrylic fiber Acrilan in England within two years.

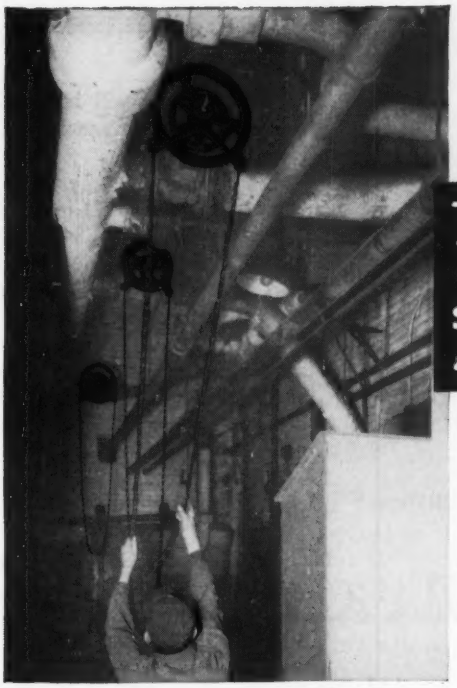
**Du Pont Co. of Canada, Ltd.** is building a $7 million commercial explosives plant near North Bay, Canada.

**Borden Co.,** New York, plans a $750,000, 500,000 lb./yr. synthetic resin glue factory in Manila in the Philippines.

**Inland Chemicals Ltd.** has started up a 100 ton/day sulfuric acid plant at Fort Saskatchewan, Alta.

**Dewey and Almy Chemical Co.,** division of W. R. Grace & Co. has completed construction of a new plant to produce Cryovac plastic bags in Greenville, S. C.

**G and A Laboratories** will use a new Battelle Institute-developed process to produce a free-flowing form of pelletized stabilized rosin. With a capacity of 2,500



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*NEWLY REDESIGNED* for greater strength—easier, quicker, more solid assembly—elimination of rust-dripping spring steel.

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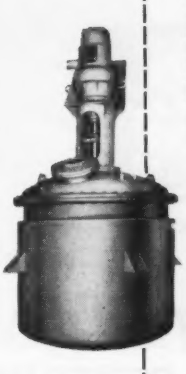
EQUIPMENT COMPANY

**GEORGE G. RODGERS NEW EQUIPMENT DIVISION**



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  ***to 6' dia. x 8' long***

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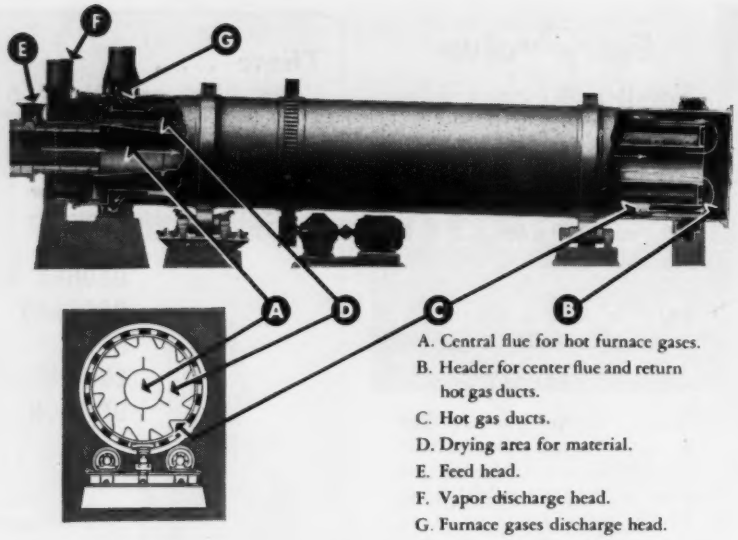


A. Central flue for hot furnace gases.
B. Header for center flue and return hot gas ducts.
C. Hot gas ducts.
D. Drying area for material.
E. Feed head.
F. Vapor discharge head.
G. Furnace gases discharge head.

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- Dry without contamination from combustion gases, regardless of fuel.
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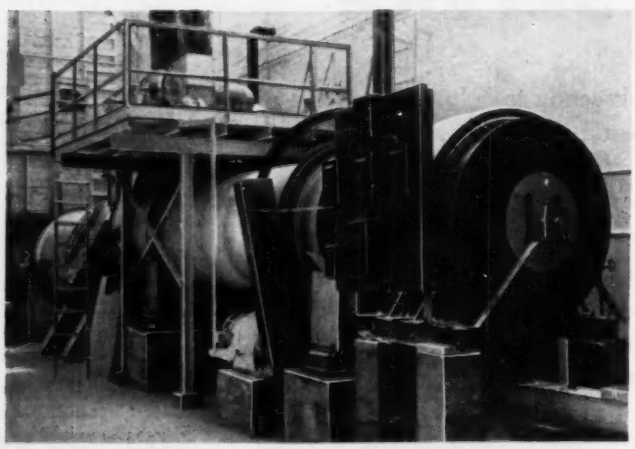
- Available fabricated with heat and corrosion-resistant metals.



Ruggles-Coles Indirect Heat Dryer handling 200 mesh talc.

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**FIRMS . . .**

lb./hr, the plant will be at G and A's present Savannah, Ga., location.

**Nuclear Development Corp. of America** will build a $400,000 critical facility and hot lab to help its engineers design better atomic reactors.

**Texas Eastern Transmission Corp.,** Shreveport, La., has contracted for 100 million cu. ft./day of natural gas from Petroleos Mexicanos for a period of 20 yr.

**Nichols Chemical Co.** will start operating a liquid aluminum sulfate plant near Thorold, Ont., early in 1956.

**California Spray-Chemical Cie. Francaise** will build a $1.5 million captan plant in France which will start supplying European market by fall of 1956.

**Wyandotte Chemicals Corp.** will enlarge and modernize its Alpena, Mich., limestone quarry.

**Horizons Inc.,** Princeton, N. J., will undertake research and development work on the electrolytic production of thorium-bismuth alloys under the terms of a subcontract awarded by the AEC's Brookhaven Laboratory.

**Phillips Chemical Co.** plans a 110 million lb./yr. plant to manufacture a new polyethylene plastic. The company is also building a sales service laboratory at Bartlesville, Okla.

**Arthur D. Little, Inc.,** industrial consulting research firm of Cambridge, Mass., has opened a Los Angeles office.

**International Business Machines Corp.** plans to establish a research and development labaratory in Zurich, Switzerland.

**Mid-South Chemical Corp.** has placed a large high-pressure ammonia storage terminal in operation in Harlingen, Tex.

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AMORPHOUS PHOSPHORUS
PHOSPHORIC ANHYDRIDE
PHOSPHORIC ACID
PHOSPHOROUS ACID
HYPOPHOSPHOROUS ACID
ALKYL ACID PHOSPHATES (Alkyl Phosphoric Acids)
SODIUM CHLORATE
POTASSIUM CHLORATE
POTASSIUM PERCHLORATE
HYPOPHOSPHITES
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Shriver Filter Presses

Next time you need a filter in your process, investigate the Shriver Filter Press—its range of types and capacities to meet practically all conditions of operating pressure and temperature, required clarity and flow rate of filtrate, degree of cake dryness, ability to extract or wash filter cake, ability to use any textile, metal or paper filter media.

Thousands of plants the world over use and reorder Shriver Filter Presses because there's an economical unit for every filtration need—from laboratory to large-scale operation.

*Catalog No. 55 will be gladly sent on request.*

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Filter Presses · Filter Media · Diaphragm Pumps

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Sales Representatives In
Decatur, Ga.–Houston, Tex.–St. Louis, Mo.
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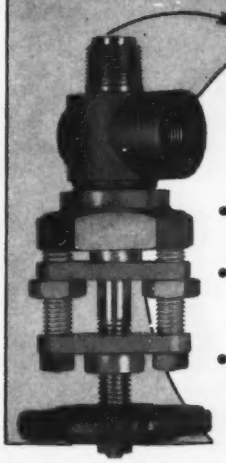
New!
Jerguson Drain or Sampling Valve



- completely self-draining
- withstands severe conditions
- foolproof operation

The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

The No. 23 is recommended for pressures up to 4000 lbs. @ 100° F. or 1000 lbs. @ 750° F. Standard with ¾" N.P.T. Male inlet and ¾" N.P.T. Female outlet. Optional features include construction with an additional connection for such uses as a steaming out line, or with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

*Write for data unit and complete details.*

JERGUSON
*Gages and Valves for the Observation of Liquids and Levels*
JERGUSON GAGE & VALVE COMPANY
100 Foliaway, Somerville 45, Mass.
Offices in Major Cities
Jerguson Trees Gage & Valve Co., Ltd., London, Eng.
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# *Chosen All Over the World*

**Presenting the complete answer to every separation problem of the process industries.**

**FILTERS • DRYERS • CENTRIFUGES**

**For batch, continuous or fully automatic operation. Produced by an Organization with more than half a century of experience.**

***Write for descriptive Bulletins***

**KRAUSS-MAFFEI—IMPERIAL**

**MÜNCHEN GERMANY**

# the valve that LIKES TO BE COMPARED

## Is a valve positioner always required?

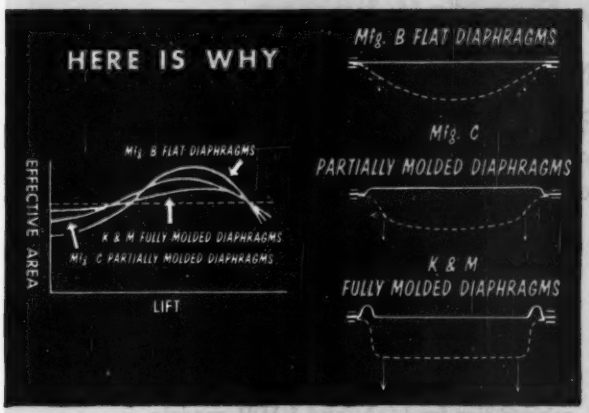
K & M provides 20-40% less positioning error. Often the need for a valve positioner is eliminated . . . because the K & M *fully* molded diaphragm gives the most constant effective diaphragm area.

K & M precision positioning also derives from long stem travel . . . lift that equals or exceeds any comparable valve . . . plus the highest power factor in the industry.

Behind it all lies one fact: K & M Control Valves are not *adapted* to high lift, they are *designed* for it. Throughout the entire range of valve travel . . . positioning is accurate and undistorted . . . control increments are finer with minimized positioning error.

Write for the K & M Valve Data Catalog, Bulletin CV-53.

***77th Anniversary . . . Oldest U. S. Pressure and Level Control Valve Manufacturer***




**With K & M *fully molded* diaphragms, virtually all components of force are vertical. Added to this, K & M gives the highest power factor (diaphragm area x lift) for precise valve positioning.**

## diaphragm control valves

**KIELEY & MUELLER, INC.**
**64 GENUNG STREET, MIDDLETOWN, NEW YORK**

K&M

# A NEW CONCEPT IN INDIVIDUAL ROOM AIR CONDITIONING!

*All living rooms and bedrooms in the 230 apartments of New York City's smart new Randall House, designed by Boak & Raad architects, feature Airtemp "All-in-Wall" Air Conditioners built right in.*

## *Airtemp installs new "All-in-Wall" units in 420 rooms in new Randall house*

AIRTEMP BUILDS AIR CONDITIONING TO FIT ANY REQUIREMENT! Now, for those buildings where a central air conditioning installation does not meet all of your needs . . . Airtemp has developed "All-in-Wall" air conditioning . . . A new concept in individual room cooling. Look at these exclusive "all-in-wall" features:

***Quiet!*** Airtemp engineered for super-quiet operation—no distracting motor noise—inside or out.

***Individual Room Control!*** Each unit can be controlled by the tenant. Automatic thermostat is standard equipment.

***Flush Outside!*** No outside projection to mar the beauty of the building.

***Full Window View!*** Unit is out-of-the-way *under* the window . . . extends only inches into the room.

***Full Capacity!*** Extra-high cooling capacity is engineered by Airtemp to meet the demands of the hottest weather.

***Easy Installation!*** Eliminates expensive on-the-spot engineering costs in new or old buildings.

***Easy Maintenance!*** Inside access plus identical cabinet size for ½, ¾ and 1 H.P. models.

***Individual Metering!*** Each tenant absorbs the cost.

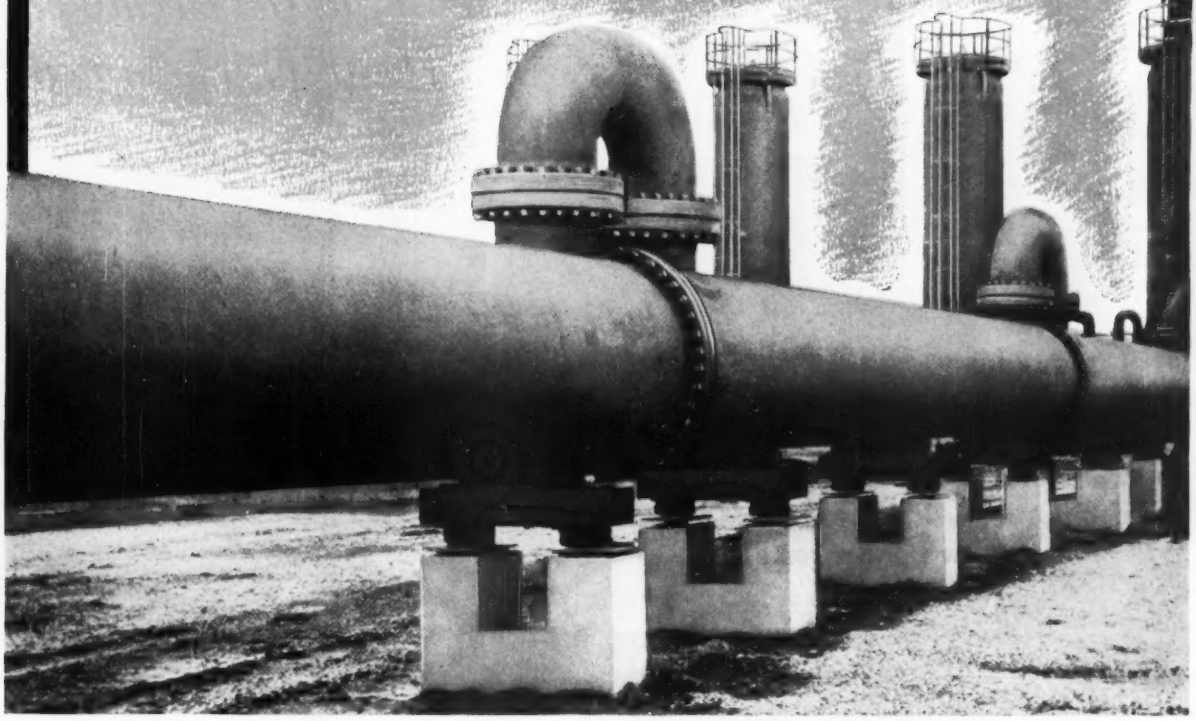
*All these services are yours when you air condition with Airtemp . . . The top engineers of Airtemp Construction Corporation—local Airtemp servicemen—plus on the spot personnel equipped to guarantee efficient operation through all the years ahead. Write Airtemp Construction Corporation, Dayton 1, Ohio, for further details.*

Airtemp
DIVISION
CHRYSLER CORP

**AIR CONDITIONING FOR HOMES • BUSINESS • INDUSTRY**

# LOOK to ALCO

## for maximum heat transfer efficiency



**150 FT "TRAIN" HEAT EXCHANGERS,** designed and built by ALCO with special flange-to-flange construction, step up efficiency at Tennessee Gas Transmission Company's gas processing plant at Gabe, Kentucky.

Behind every ALCO heat exchanger are many years of experience in the design and fabrication of superior heat transfer equipment.

ALCO Heat Exchangers are custom-engineered to meet individual requirements . . .

. . . in diameters up to 12 feet

. . . in weights from 100 to 300,000 pounds

. . . in pressures from high vacuum to 5000 psi

. . . in temperatures from minus 300 F to 1500 F

Extensive modern plant facilities are employed in the manufacture of these heat exchangers — fabricated of carbon steel, nonferrous alloys, inconel, stainless steel, stainless-clad, nickel-clad, or lead-lined materials.

**Call your nearest ALCO Sales Engineer for full particulars about these units — or write to Box 1065, Schenectady 5, New York.**

**ALCO**

**ALCO PRODUCTS, INC.**
Schenectady 5, N. Y.
*formerly* **AMERICAN LOCOMOTIVE COMPANY**

*For low-temperature processes*

# Cut costs two ways

*with Trane Heat Exchangers!*

**1. Multiple streams in single Trane Brazed Aluminum units cut initial heat exchanger costs.**

**2. Close temperature approaches—economically maintained—lower operating costs.**

**For temperatures as low as −300°F.** in nitrogen production and hydrogen purification processes, TRANE Brazed Aluminum Heat Exchangers are proving themselves a flexible, economical solution to difficult heat exchange problems. They're cutting costs *two* important ways!

**Lower initial costs** account for one substantial saving. Efficient, *flexible* TRANE Brazed Aluminum surfaces make it possible to handle multiple streams in a *single unit*.

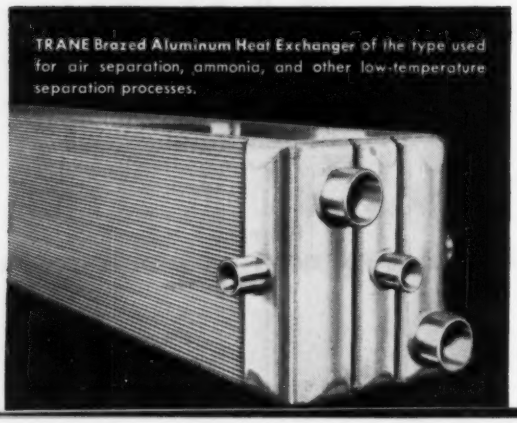
(Even installation costs are lower. These compact, lightweight units pack up to 450 square feet of heat transfer surface into a single cubic foot. They are now available in operating pressures *up to 600 psig!*)

**Lower operating costs,** plus the ability to perform efficiently and economically at low temperatures represent still another saving. Even when large heat transfer duties are involved, these units can provide temperature approaches of 5°F. or closer—*economically!* Operating costs are lower because it takes less refrigeration to bring a specified liquid or gas to desired temperature.

Little wonder, then, that so many new, modern air separation and ammonia plants rely on efficient TRANE Brazed Aluminum Heat Exchangers.

**If you have a heat transfer problem**—if it involves *low temperatures, multi-stream exchange* or *close approaches*—it's time to call TRANE.

Our 30 years' experience in all phases of heat transfer is at your disposal. Just contact your nearest TRANE Sales Office. There is one near you in our network of 90 U.S. and 17 Canadian offices. Or write on company letterhead to TRANE, La Crosse, Wis.



TRANE Brazed Aluminum Heat Exchanger of the type used for air separation, ammonia, and other low-temperature separation processes.

**TRANE**

**MANUFACTURING ENGINEERS**

*One source, one responsibility for: Air Conditioning • Heating Ventilating • Heat Transfer Equipment*

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Trane Co. of Canada, Ltd., Toronto • 90 U.S. and 17 Canadian Offices.

# Chemicals...

## *by the carload*

**In shipping your chemical production today you'll find new cleanliness, safety, convenience and economy in bulk consignments via North America's fleet of modern, specialized tank cars. You eliminate the superfluous handling, the cumbersome loading and unloading of old fashioned methods. You specify your requirements and we will meet them with your special linings that eliminate contamination, corrosive action, contact with metal. And your shipments go safe and sure to any destination on the continent where there's a railroad track. Call us. You'll get full co-operation.**

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NORTH WESTERN REFRIGERATOR LINE COMPANY
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***For special products requiring special care***

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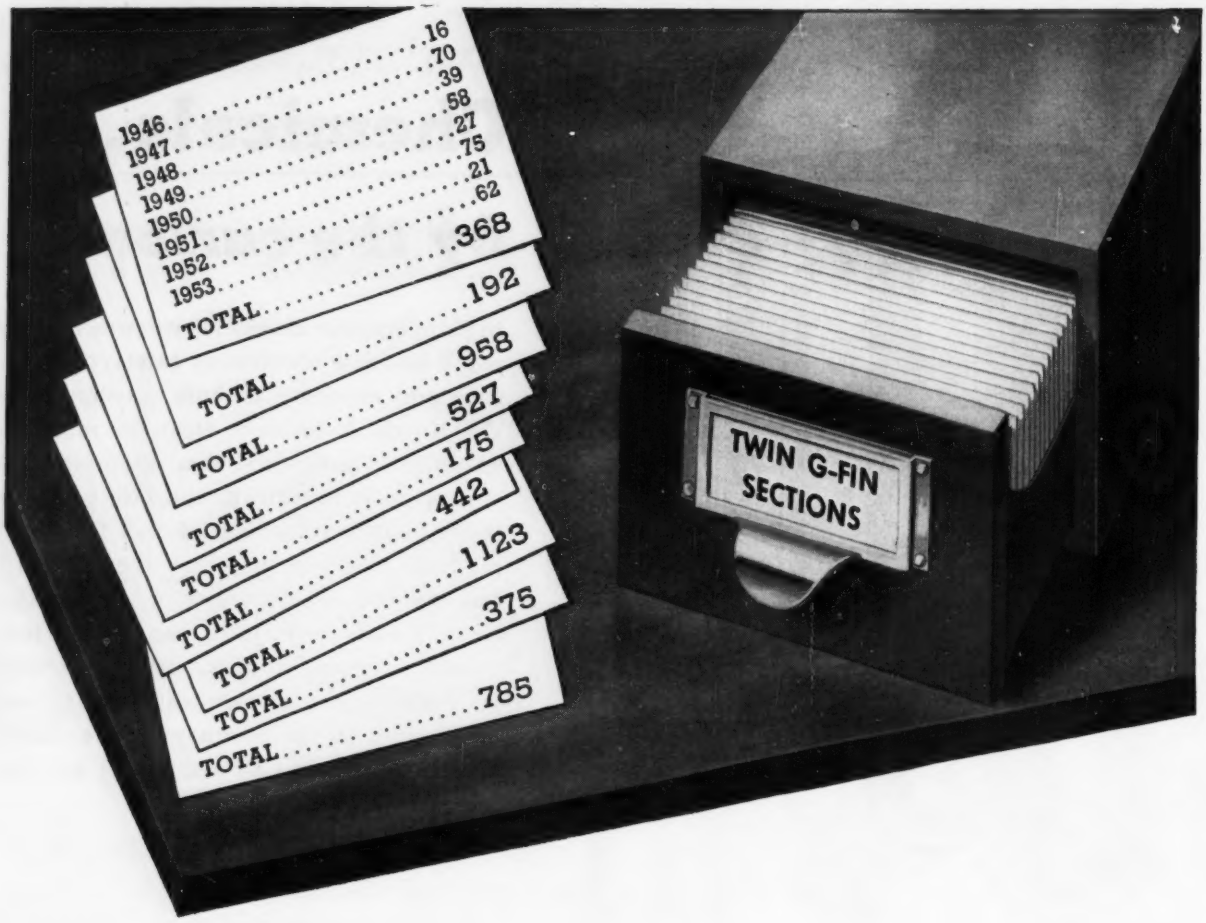


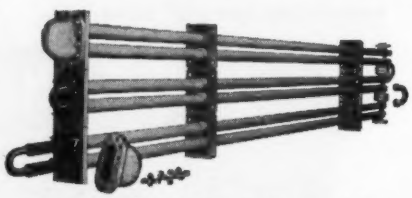

# They're all repeat orders for G-R Twin G-Fin Sections

Re-orders — the ultimate proof of satisfactory service — run into the hundreds for many, many purchasers of G-R Twin G-Fin Sections.

Users have re-ordered and **continue to re-order** these units because of the uniformly top-notch performance of each successive installation. In many instances, they have re-ordered and **continue to re-order** to extend the application of these many-purpose heat exchangers to services throughout their plants. Customers all over the country have re-ordered year after year for ten, fifteen years and more, running up the astonishing total of more than 70,000 installed Twin G-Fin Sections during the course of the 25 years since Griscom-Russell originated this design of heat transfer apparatus.

Write for Bulletin 1400 describing the G-R Twin G-Fin Section in detail.

**Sectional view of the G-R Twin G-Fin Section**



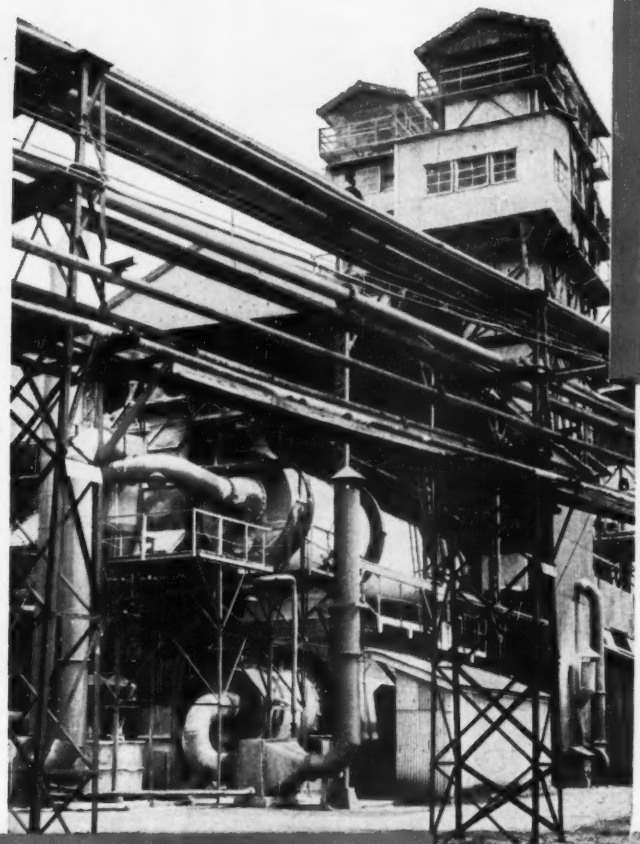
**Stack of G-R Twin G-Fin Sections partially dismantled to show ready accessibility of the longitudinally finned heat transfer elements**

G-R HEAT TRANSFER APPARATUS

THE GRISCOM-RUSSELL CO.
MASSILLON, OHIO
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

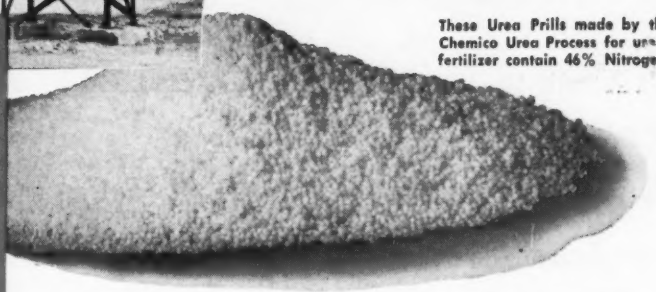
GR-349

# Twin G-Fin Section



# 95% ammonia efficiency

## in the CHEMICO Urea Process



These Urea Prills made by the Chemico Urea Process for use as fertilizer contain 46% Nitrogen.

# 76% conversion of ammonium carbamate to urea

The Chemico Urea Process is employed in a 120 standard tons per day Urea Plant, shown in the photograph, which went into operation in the Fall of 1952 at Niihama, Japan, for the Sumitomo Chemical Company.

This same process is being used for a 90 short tons per day Urea Plant which Chemico is presently designing for Nihon Gas Kagaku Kogyo, Japan.

Chemico Urea Process operating records show an actual conversion of 76% in the presence of 200% excess ammonia. Theoretical maximum conversion when the stoichiometric feed ratio is used is only 48%.

**CHEMICAL CONSTRUCTION CORPORATION**

A UNIT OF AMERICAN CYANAMID COMPANY

525 WEST 43RD STREET, NEW YORK 36, NEW YORK

*Cable Address: Chemiconst, New York • Technical Representatives: Cyanamid Products Ltd, London*

*South African Cyanamid (Pty) Ltd., Johannesburg*

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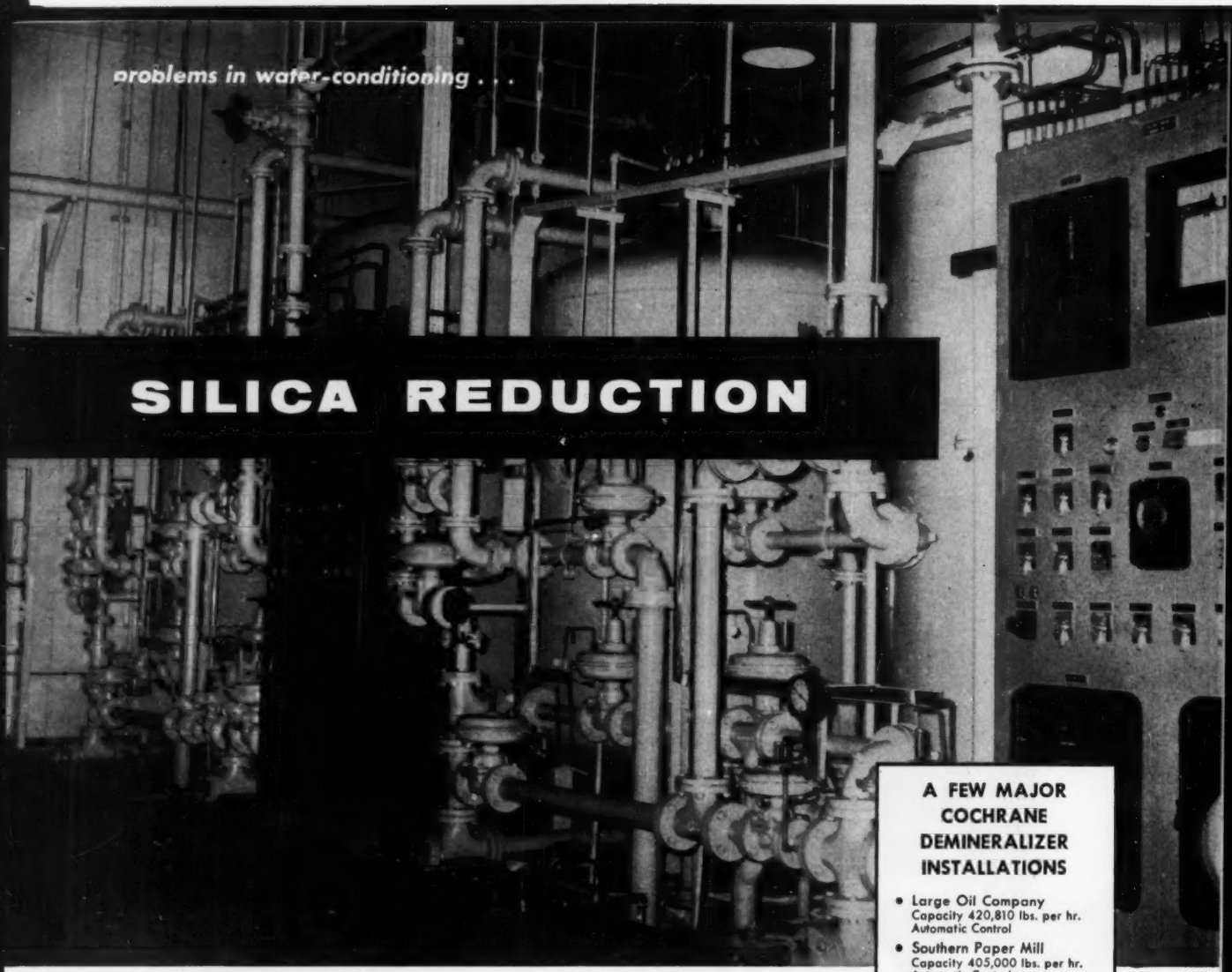


**A FEW MAJOR COCHRANE DEMINERALIZER INSTALLATIONS**

- **Large Oil Company**
  Capacity 420,810 lbs. per hr.
  Automatic Control
- **Southern Paper Mill**
  Capacity 405,000 lbs. per hr.
  Automatic Control
- **Textile Manufacturer**
  Capacity 360,000 lbs. per hr.
  Automatic Control
- **Utility**
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  Automatic Control
- **Aluminum Producer**
  Capacity 387,000 lbs. per hr.
  Automatic Control
- **U.S. Government**
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  Automatic Control
- **Automobile Manufacturer**
  Capacity 182,268 lbs. per hr.
  Automatic Control
- **Pharmaceutical Company**
  Capacity 29,880 lbs. per hr.
  Automatic Control
- **Chemical Manufacturer**
  Capacity 15,000 lbs. per hr.
  Manual Control
- **Steamship Installation**
  Capacity 1,776 lbs. per hr.
  Manual Control

## *For your protection*

## buy **Cochrane's** *experience*

## *in demineralization*

An impressive list of Cochrane 2-bed, 3-bed, 4-bed and mixed bed Demineralizer installations have been providing continuous protection for years in many outstanding high pressure power plants in public utility and industrial fields.

The illustration above is just one of many such installations. Designed for a large paper company, it produces an effluent with a silica content of as low as 0.02 ppm and total dissolved solids of as low as 0.4 ppm. Cation units are 6′ x 6′ and anion units 6′ x 8′ providing demineralized water supply of over 100,000 lbs. per hour for 1200 psi boilers.

Demineralized water quality is superlative. Cochrane's progress in solving the many problems associated with demineralization is the result of untiring research by their staff of chemists, engineers and research men. This background is your assurance of satisfactory operation. Why not take advantage of it? For the answer to your water conditioning problem . . . consult Cochrane first. Ask for Bulletin 5800-B.

COCHRANE CORPORATION — WATER AND HEAT ENGINEERS SINCE 1863 — PHILADELPHIA

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# BACK IN THE 1880's

## *when plate glass was first commercially produced*

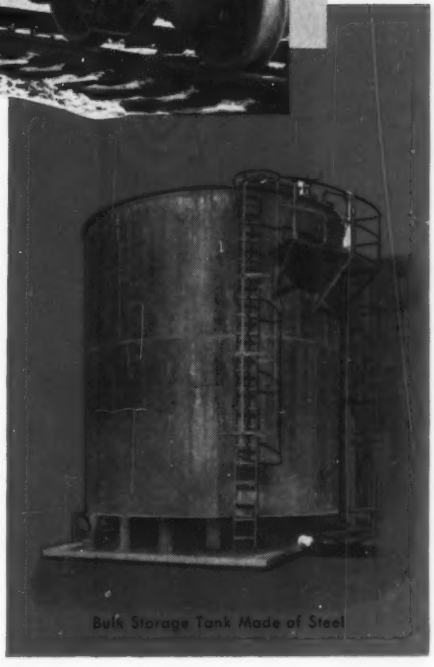
High Pressure Autoclave

# Koven

## WAS MAKING INDIVIDUALIZED CHEMICAL EQUIPMENT

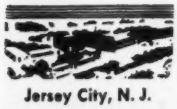
To flourish, American industry has always depended upon a careful selection of the best facilities. That's why, as far back as the early 1880's, chemical manufacturers insisted upon the use of KOVEN-built equipment—to ensure the most efficient means to fast, economical production.

Designed and built to fit specific needs, KOVEN Individualized Equipment has, for almost 75 years, contributed to the ever-increasing growth of the chemical industry. Why not let this invaluable experience work for you, too. There's no obligation—so call or write now for a consultation with a trained KOVEN representative. Send for Bulletin #550.



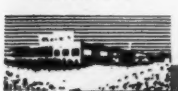
Bulk Storage Tank Made of Steel

Plants:



Jersey City, N. J.

Dover, N. J.



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- **all clad materials**

**Fabrication to all A.S.M.E. Codes**

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**KOVEN equipment in all metals and alloys includes: High pressure vessels, extractors, mixers, stills, kettles, tanks, stacks, breechings. Shop and field erected storage tanks to 2 million gallons, high vacuum testing.**

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Experience in all quarters of the world has given Procon an intensive knowledge of *local* operating conditions, building requirements and labor availability that has proved valuable in all phases of plant construction.

Combine Procon's broad construction experience in the petroleum, petrochemical and chemical fields with this local know-how and you have the really important reason why Procon should be consulted when you are planning any construction project.

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WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

"THE BRAND OF PROGRESS"

*By Heat Exchanger Specialists*

▲ SYNOPSIS OF AD #8: To assure complete vapor and fluid-tight metal-to-metal tube sheet joints, Western Supply utilizes 100% application of controlled torque tube rolling. The electronically-controlled tube expander eliminates the human element guaranteeing a positive "set" on each and every tube-to-tube-sheet. Thus, expansion is uniform . . . distortion of the tube or tube sheet is eliminated.

X-RAY
an inside look at
WESTERN HEAT
EXCHANGER
quality!
Recent advancements in the process industries have been typified by increased temperatures and pressures. Alloy heat exchanger fabrication today requires vigilance in quality control to assure that the units are as free from human defect as it is possible to make them.
In the Western welding shops one such quality control method is X-raying of critical welds.
This is accomplished not only where accepted fabrication codes require, but also as periodic checks on the welding performance of each worker.
This same close examination of quality extends into Western's other departments—raw materials, machining, assembly and testing.
Because of the rigid quality control procedures, you can have full confidence in the construction of all Western exchangers.
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HEAT EXCHANGERS
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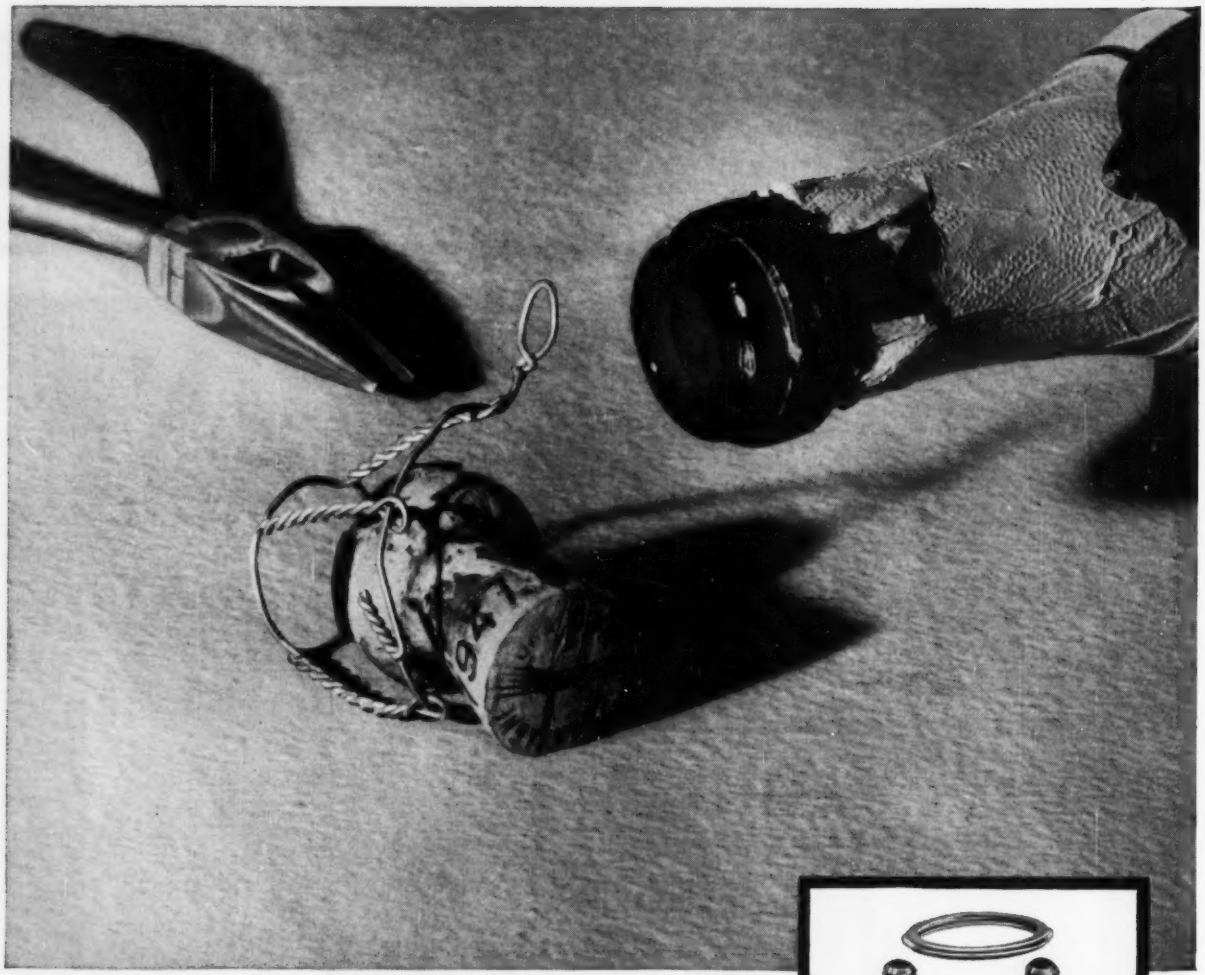
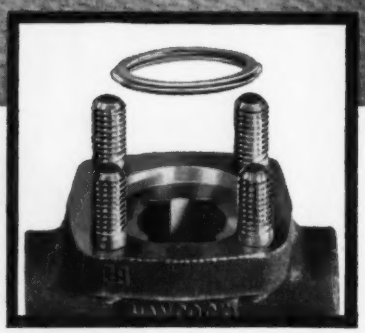
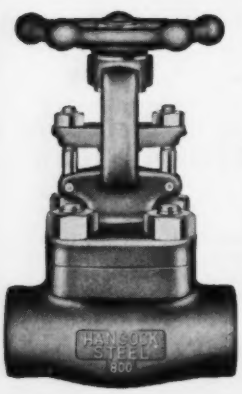
PROCESS INSTRUMENTS & EQUIP. CO.—North Bldg., Charleston, W. Va.
H. W. SEVERANCE—Marion E. Taylor Bldg., Louisville, Ky.



# SEAL-ABILITY
## that prevents blowouts





THE FLEXITALLIC GASKET creates a positive, pressure-tight seal in the bonnet joint of the Type 950 Hancock Steel Gate Valve. It is a spiral-wound ribbon of stainless steel with asbestos filler and spring-like compressibility. The gasket can be reused – cannot be flattened as the flanges which retain it form an integral compression gauge. Because the gasket rests in a groove in the body flange, it cannot blow out *even if pressures exceed ten times the rating of the valve.*

Only a specially-designed bonnet joint can fully utilize the tremendous sealing power of the Flexitallic gasket. And, only Type 950 Hancock Steel Gate Valves have Flexitallic gaskets. Advanced engineering proves that an investment in quality pays dividends in trouble-free performance. Let your nearby Industrial Supply Distributor explain fully. Phone him today.

**HANCOCK VALVES**

*A product of*

**MANNING, MAXWELL & MOORE, INC.**

*Watertown 72, Massachusetts*

**In Canada:** *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

# high quality product

*boost average ratings as much as 2 octane numbers with the*

## *Ljungstrom® Air Preheater*

With waste heat recovered and returned to the furnace in combustion air, the most modern heat-transfer systems can be operated at peak efficiency.

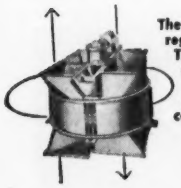
That's why you boost product quality with the Ljungstrom Air Preheater. It's heat-recovery efficiency makes possible advanced furnace designs that assure remarkably close control of processing. And finer control means a more uniform product . . . with average ratings as much as 2 octane numbers higher. One still's added income just from higher product quality is $58,000 annually.

HOW FAST IS "WRITE-OFF"?

**In earnings from higher octane ratings, many refiners write off the cost of the Ljungstrom installation in less than two years. This time is cut to *nine months and even less*, when the other Ljungstrom advantages are taken into account — saves up to 20% in fuel costs . . . permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . and minimizes slag.**

**For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits obtainable in fuel burning equipment — call or write The Air Preheater Corporation.**

*Wherever You Burn Fuel, You Need Ljungstrom*



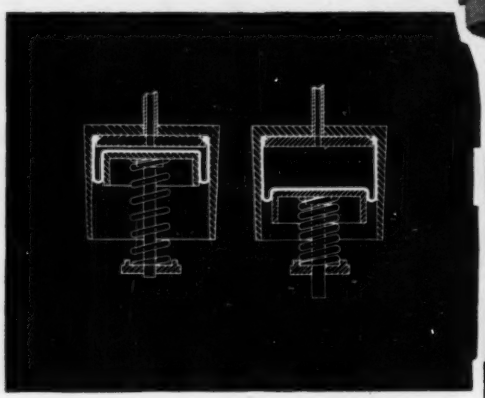
**The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transfered from the waste gases to the incoming cold air.**

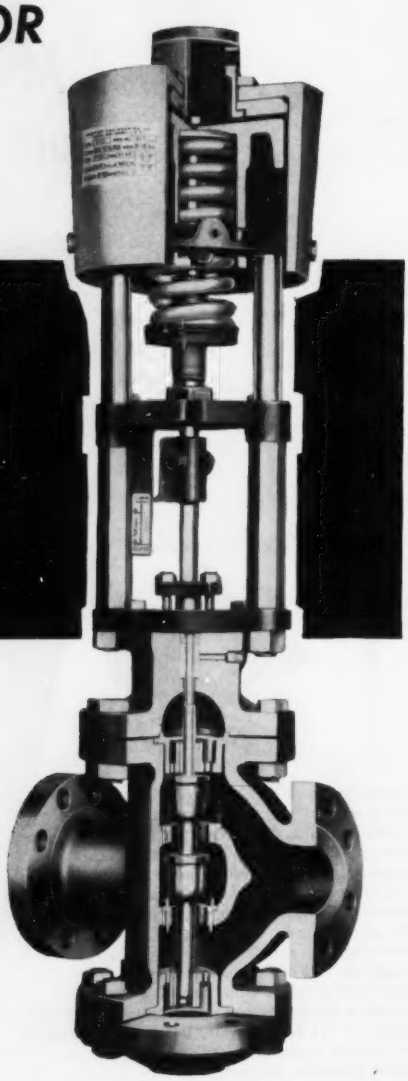
**The Air Preheater Corporation** **60 East 42nd Street, New York 17, N. Y.**

# FOR FLUID CONTROL

## THE NEW FOSTER CONTROL VALVE WITH ISOFORCE ACTUATOR

### GIVES YOU MORE POWER WHEN YOU NEED IT...





...with the Foster Bellofram construction, no force is lost at end of the stroke where spring compression requires the maximum force. This assures linearity of instrument and stem positions.

These new control valves are available in sizes starting at ½" with materials and end connections to suit operating conditions.

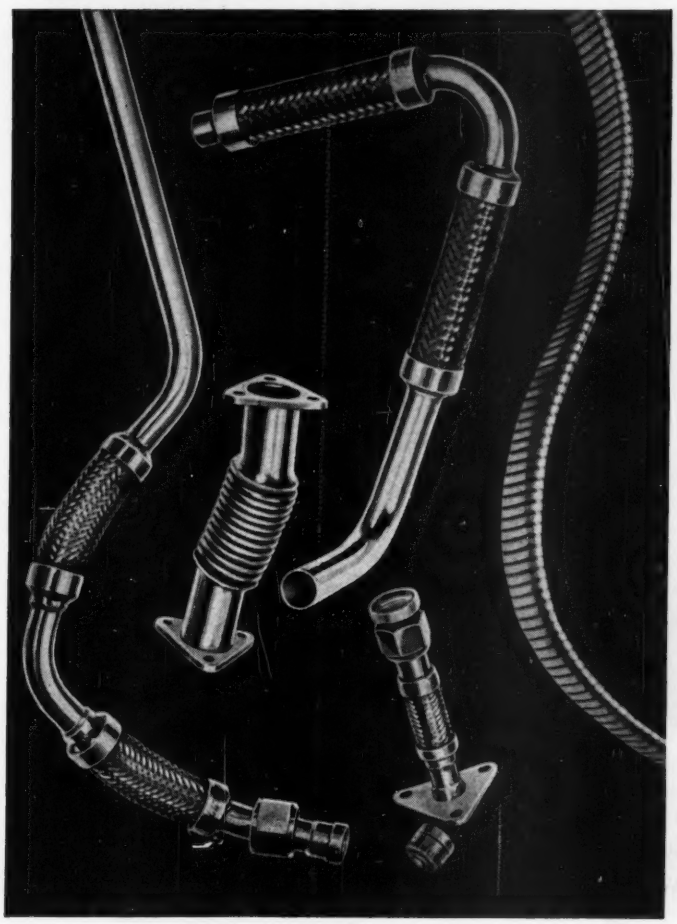
*For complete technical information, ask for Bulletin CV-1*

FOSTER ENGINEERING COMPANY
835 LEHIGH AVENUE UNION, N. J.

AUTOMATIC VALVES · CONTROL VALVES · SAFETY VALVES · FLOW TUBES

# Standard AMERICAN flexible connectors like these may solve your problem . . .

## If not, we'll design a "special" at no extra cost



What's your connector problem? Vibration? Movement? Misalignment? Cramped space? Want help solving it? Tell us what material you have to convey, temperatures and pressures involved, kind of end fittings you need, and the special conditions which will affect service. Our engineers will be glad to work with you. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.* In Canada: *The Canadian Fairbanks-Morse Co., Ltd.*

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WHEREVER CONNECTORS MUST MOVE

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**flexible metal hose and tubing**

**an ANACONDA® product**

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EXON: each resin engineered for a specific problem

# REDUCE YOUR "DOWN-TIME" WITH OPW valves

"Down-time" frequency for valve repair is appreciably lessened with OPW Valves specifically engineered for hazardous liquid service. They are ground tighter, engineered with larger stuffing boxes, machined to closer tolerances, and produced of the finest grades of bronze and aluminum. Highest possible quality is reflected in the dependability, ruggedness and precise flow control of all OPW Valves.

Recognizing the need and answering the demand for a valve which would reduce the tare weight of truck tanks without sacrificing peak efficiency, OPW has developed the lightweight 676. After exhaustive tests, it has been added to the complete family of OPW Valves.

**CHARACTERISTICS OF THE 676 VALVE**

Flanged or screw body and bolted bonnet of OPALUMIN, as strong as bronze, one third the weight. Interior parts of precision machined bronze. Ball and socket double discs, self aligning, tapered design seating against hand lapped renewable bronze seat rings for a sure, vapor-tight, no-leak closure. *Renewable seat rings are threaded and seated against shoulder,* so despite contraction and expansion of the body, the threaded ring remains seated. Compound double acting threads allow closer clearance when valve is opened, require fewer turns to open and close. Strong, large diameter stems do not bend.

Available in 3" size.

**GATE VALVES • EMERGENCY VALVES • CROSS CHECK VALVES • CROSS VALVES • CHECK VALVES • GLOBE VALVES • PRESSURE RELIEF VALVES • COMPRESSION CHECK VALVES • LOADING VALVES**

OPW CORPORATION FOR HANDLING HAZARDOUS LIQUIDS — OPW — VALVES • FITTINGS • ASSEMBLIES — CINCINNATI 25, OHIO

## OPW CORPORATION

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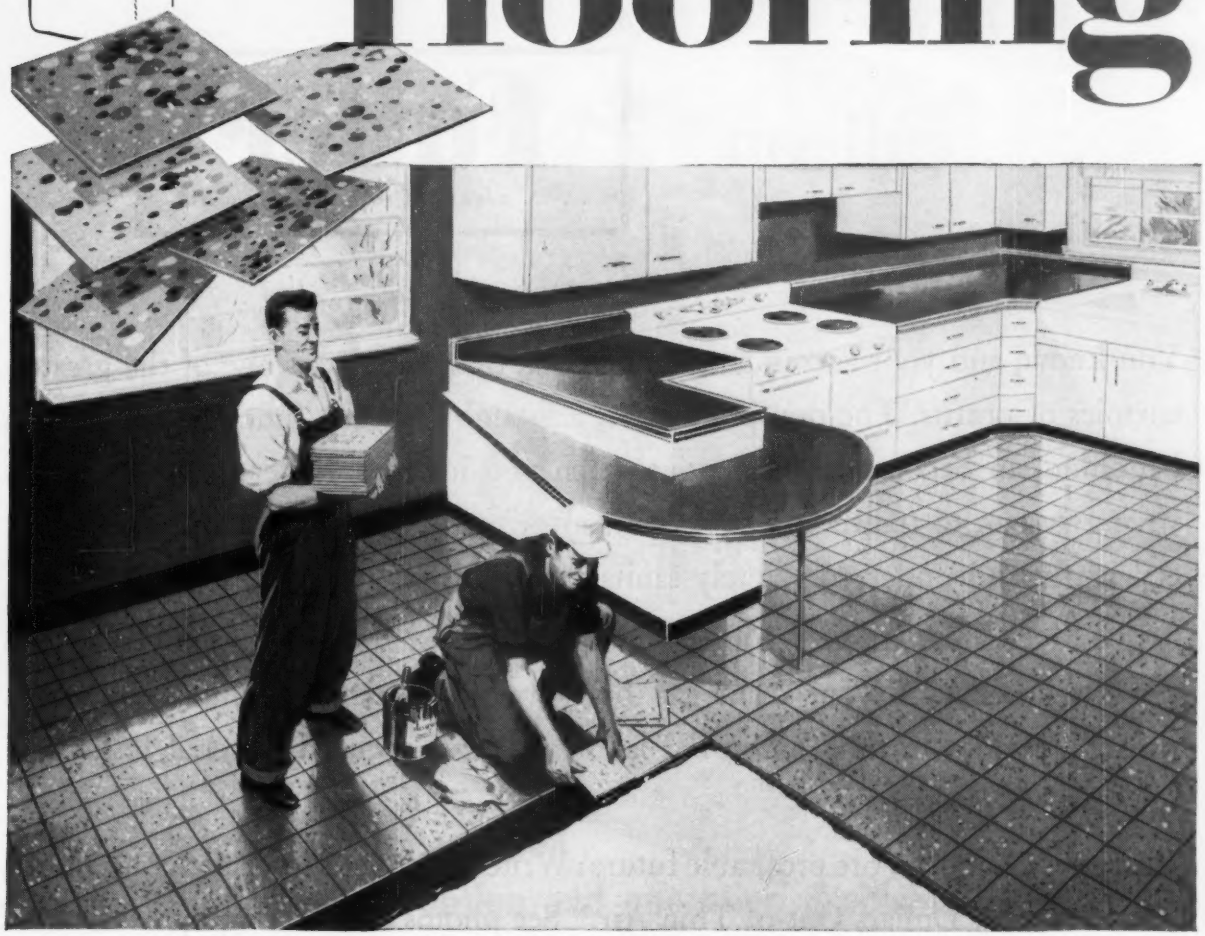
## EXON: each resin engineered for a specific problem

# EXON 468

specifically for

# flooring



**Higher bulking density** of EXON 468 increases the banbury output 10 to 25%! It makes processing easier, since it permits fast fusion at reduced temperatures.

**A superior resin in every respect,** EXON 468 offers good heat and light stability, high thermoplasticity, compatibility with conventional vinyl plasticizers, stabilizers and pigments.

**Used as the base resin** in vinyl asbestos floor tile formulations, EXON 468 provides new production economies — and superior end products.

For suggestions on developing new products, or improving established ones with EXON 468—or for complete information or technical service on the growing line of versatile EXON resins, contact:

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FIRESTONE PLASTICS COMPANY, POTTSTOWN, PA., DEPT. 628B
DIVISION OF THE FIRESTONE TIRE & RUBBER COMPANY

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## . . . provides valuable information to help you solve many design and operating problems

Here is a new handbook which can be a valuable aid to you in many ways in improving operations and lowering maintenance costs in your plant.

Whether your problem is reducing heat loss, fighting corrosion, sealing gases and liquids, controlling motion, filtering liquids, improving formulae or protecting against fire, weather and wear, this handbook will aid you in finding the solution.

This handbook contains 52 pages of useful up-to-date engineering information on Johns-Manville products used in the process industries. The answers to your thermal insulation problems may be found in the section which shows methods of calculating heat transmission. Also included are tables of heat losses from bare surfaces and equivalent thicknesses of pipe insulation. Graphs provide information on surface resistance for both pipes and flat surfaces.

For your copy of this handbook, simply fill out the attached coupon and return it to us.

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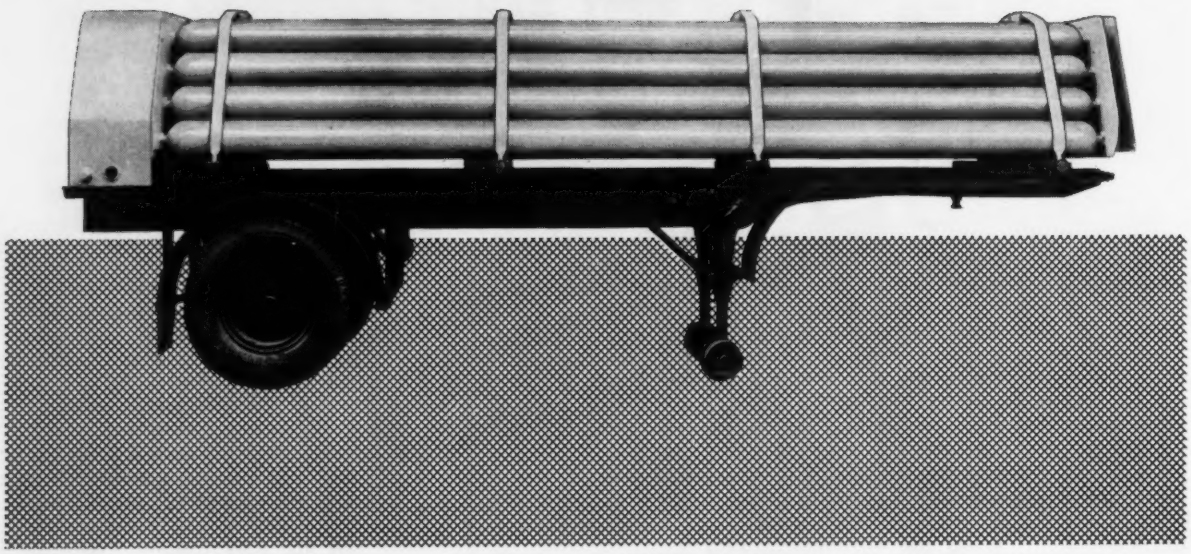
# Is this the answer to your gas transportation and storage problem?



Taylor-Wharton GAS TRANSPORTS are a practical solution to the problem of transporting and storing large quantities of compressed gases.

Oil refineries use them for hydrogen and nitrogen in starting the Reforming process. Chemical, electronics and food processing companies which have their own gas generating equipment use them for inter-plant distribution of gases. They also find gas transports excellent as a flexible means of temporary storage.

The advantages of Taylor-Wharton Gas Transports are especially notable with the lighter gases which are not easily liquefied, such as hydrogen and helium. They are also used for oxygen, nitrogen, boron trifluoride, ethylene and other industrial gases.

In some cases the gas transports are used instead of large permanent storage installations, *for a substantially smaller investment and with greater flexibility in use.*

The tubes are made in one of our plants to ICC-3A 2400 specifications. After fabrication they are completely heat-treated. The trailers are specially constructed for use with these transports. They are available in single and double axle models, 30 or 38 tube capacities.

How can they serve you? Describe your gas transport and storage requirements and we will advise you.

**Taylor-Wharton Division**

**Harrisburg Steel**

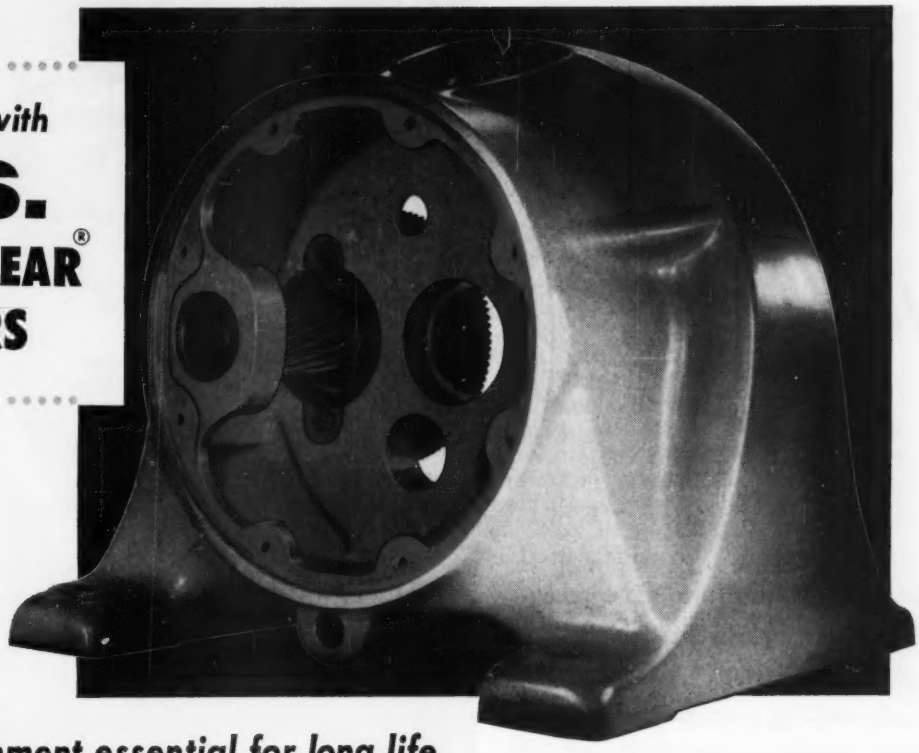
CORPORATION HARRISBURG PENNSYLVANIA

More than a century in Harrisburg

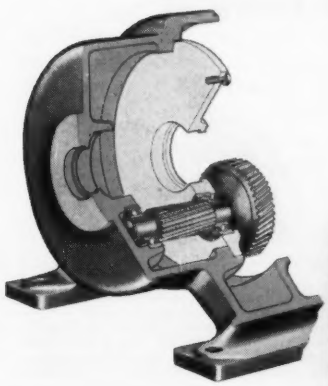
# How One Piece Case Increases Gearmotor Life

*Exclusive with*

**U.S. SYNCROGEAR® MOTORS**

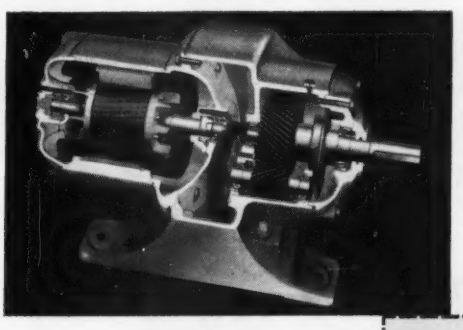


## *Gear alignment essential for long life*



COMMON TWO-PIECE DESIGN MAY MISALIGN!

The U.S. design is a single solid unit which maintains alignment. Both bearings of the countershaft are in the same casting. The bores are therefore absolutely concentric and can never become misaligned, whereas in common units, a two-piece casting is used which may cause misalignment. The rugged U.S. pyramidal gear case gives stronger and more accurate support to the bearings and shaft, insuring permanent alignment for longer trouble-free motor life.



### *U.S. Features:*

- *Solid Shank Built-In Pinion*
- *Asbestos-Protected Windings*
- *Hardened Gear Teeth*
- *Positive Automatic Lubrication*
- *Normalized Castings*
- *Compactness*
- *Dependable, Economical Quiet Operation*
- *Wide Selection of Types and Sizes*

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*Mail Coupon for Free Descriptive Multi-color Booklet with all the facts you should know about geared motors.*

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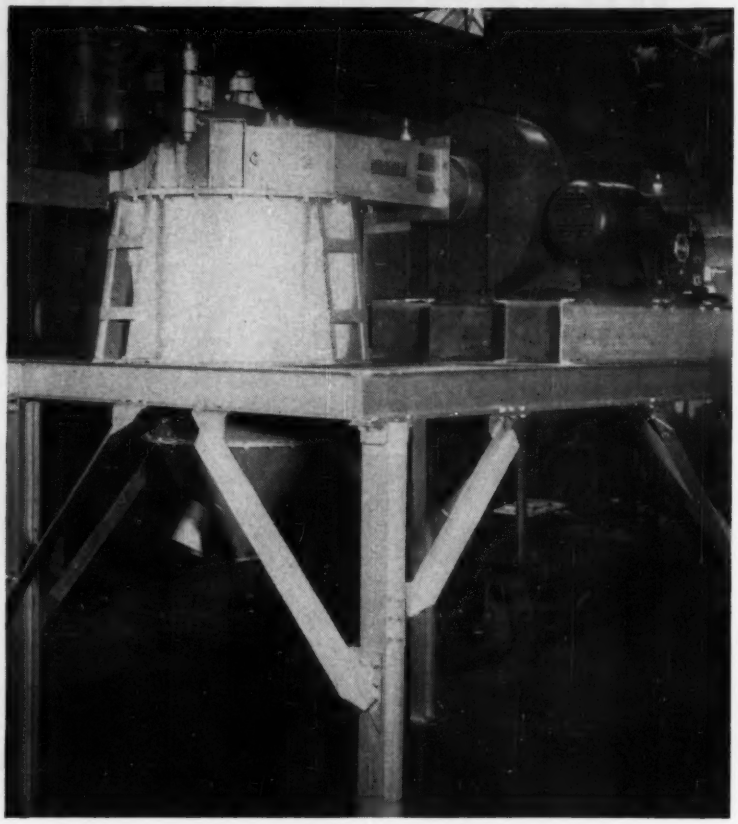
# NEW TYPE STURTEVANT AIR SEPARATOR

## *Recovers Fines in Micron Ranges*



Now the famous Sturtevant Whirlwind Air Separator, so widely used throughout industry for fast recovery of fines, has been specially designed to "pick-off" classified materials such as pigments, limestone fillers, plastics, oyster shells, etc., in micron sizes.

These highly efficient air separators select a continuously uniform product of desired fineness. Used in a closed circuit with grinding mills, they increase production, cut power costs.

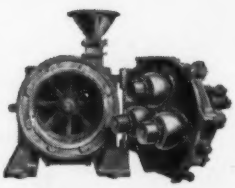
Large feed opening, rugged construction, ease of adjustment, low power consumption assure economy of operation and minimum upkeep. Write for further information.

**STURTEVANT**
**MILL COMPANY**
**100 CLAYTON STREET**
**BOSTON 22, MASS.**

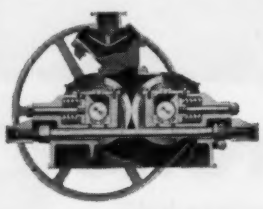
*Designers and Manufacturers of:*
CRUSHERS • GRINDERS • SEPARATORS
CONVEYORS • MECHANICAL DENS and
EXCAVATORS • ELEVATORS • MIXERS

### OTHER STURTEVANT EQUIPMENT

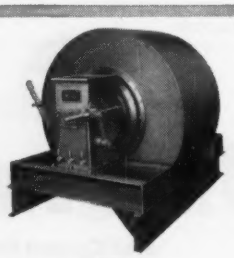
**MICRONIZER ® GRINDING MACHINE**
A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired.
Sturtevant Micronizer grinding machines are available in many sizes and capacities.



**RING-ROLL MILLS**
For medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operate in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



**CRUSHING ROLLS**
For granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.

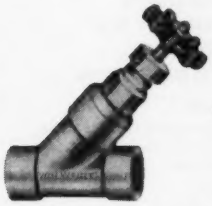


**BLENDER**
Four-way mixing action assures a thoroughly blended product. Open-door accessibility permits easy cleaning. Available in many mixing capacities for ¼-ton per hour and up.

# Now WALWORTH *PVC* VALVES and FITTINGS

## give you the greater protection and longer service of *all-plastic* piping systems!

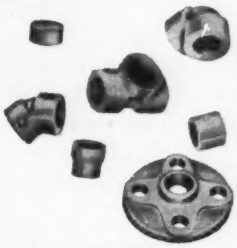
The new Walworth plastic Valves and Fittings are made of rigid polyvinyl chloride which is non-aging, non-corrosive and non-toxic and has extremely low flammability and high resistance to chemical attack. Walworth PVC products are molded by General American Transportation Corporation. Each product bears the stamp of Walworth's long established engineering skill and reliability — your assurance of safe, trouble-free valves and pipe fittings.



**Walworth PVC Y-Globe Valves** are designed to regulate the flow of alkalis, acids, inorganic salt solutions and other troublesome fluids commonly found in food, chemical and allied industries. They will give exceptional service at temperatures as high as 150°F and are designed for use with schedule 80 pipe. Other features of these valves include: (1) Three chevron, Teflon packing rings give you a leak-proof seal without binding the stem. (2) No useless threads to accumulate troublesome dirt because no stem threads enter the interior of the body. (3) Snap-on spherical plug with ball-to-cone seating arrangement to assure a tight line-contact seal between disc and seat regardless of any minor inaccuracies in alignment. (4) Full 45° angle of stem with center line of pipe to reduce pressure drop and turbulence. (5) Generously designed flow passage at the valve seat for a more even flow. (6) Back seat design allows repacking when wide open under pressure. (7) Polyethylene bonnet gasket to assure a perfect body-to-bonnet seal.

**Walworth PVC Diaphragm Valves** come equipped with neoprene discs. Other diaphragms especially suited to your application can be furnished. "R-2" rubber diaphragms are commonly used in systems handling dilute acids and alkalis. "J-1" Teflon diaphragms are recommended for maximum chemical resistance.

Valve design features: (1) No stuffing box or packing to replace. (2) A resilient diaphragm connected to the compressor by a stud assures a leakproof closure on the body weir or valve seat even when slurries or semi-solids are in the line. Diaphragm easily replaced without removing the valve from the line. (3) Streamlined flow area in valve body makes valve self cleaning and allows fluids to flow equally well in either direction. (4) Separation of valve body from the sealed metal bonnet protects fluids from contamination. Fluids contact only the valve body and diaphragm. (5) Completely enclosed metal bonnet protects stem from breakage and distortion.



**Walworth PVC Fittings** assure uniform thermal expansion of pipe and fitting threads when used on plastic pipe. They eliminate the danger of jammed threads, loose joints and the chance of galvanic corrosion. These screwed pipe fittings are: (1) Designed for use on schedule 80 of plastic pipe. (2) Walls are of uniform thickness accurately molded. Proportions are skillfully worked out in all sizes and types of fittings. (3) Fittings are chamfered to protect the thread and afford easy entrance of the pipe. Long bands provide reinforcement at the points of severest strain.

This booklet contains all the details about Walworth PVC products that you'll want to know. It describes mechanical and thermal properties, working pressures, sizes and dimensions, application and assembly data. For your free copy write to us. Please use company letterhead.

**WALWORTH**

valves . . . pipe fittings . . . pipe wrenches

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WALWORTH COMPANY OF CANADA, LTD.

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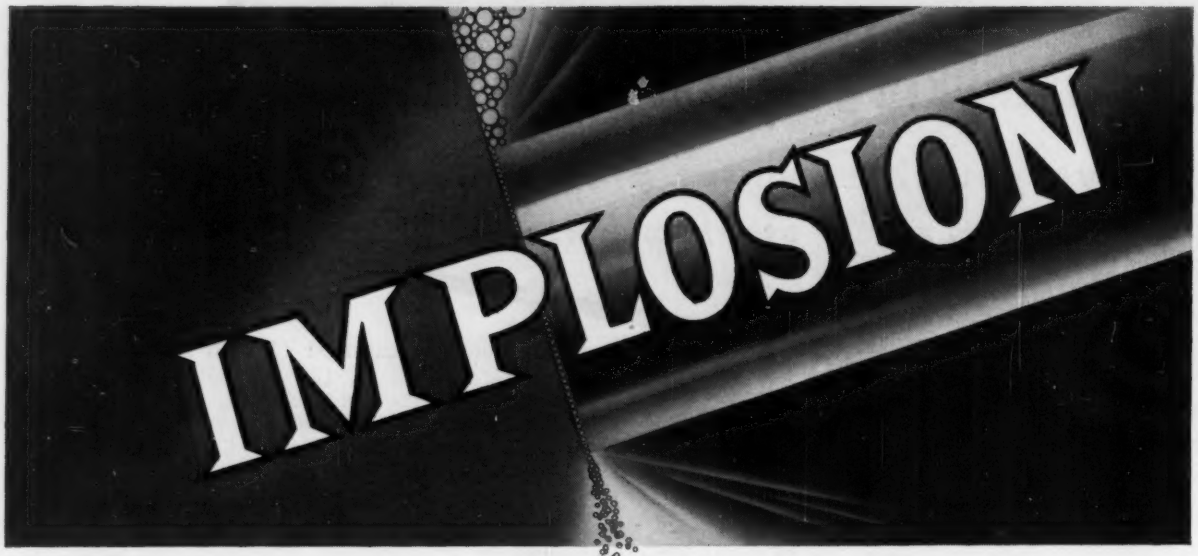


# makes many products better in a Gaulin Homogenizer

What happens when you put your product in a Gaulin Homogenizer? Just this: A Gaulin forces your product at tremendous velocity through a microscopic orifice . . . shears, shatters and implodes agglomerates down to their ultimate particle size.

It breaks them uniformly finer . . . mixes them evenly . . . to provide a long list of important advantages.

For example, a Gaulin provides a smoother texture, a freer flow. Accents the taste, scent and color of a product. Speeds chemical reactions, dispersion of ingredients — and reduces the amount of costly ingredients required. Stops separation and improves lubricity, just to mention a few.

***How about your product?***

We'll be glad to show you how a Gaulin can improve your product and cut your processing costs. Let us work with you toward solving any specific problems you may have. Write today for more information.

**MANTON-GAULIN MFG. CO., INC., 55 Garden Street, Everett 49, Mass.**

### Some Typical Products Improved by Gaulin Homogenizers

**PHARMACEUTICAL**
Emulsions and dispersions. Gaulins make them stable, uniformly finer. Permit accurate reproduceability.

**LIQUID STARCH**
Improves transparency, clarity, and stops separation, at lower cost than other methods.

**GREASE**
Improves lubricating value and stability. Increases service life.

**PIGMENT DISPERSIONS**
Provides continuous high capacity producing dispersions of ultimate particle size.

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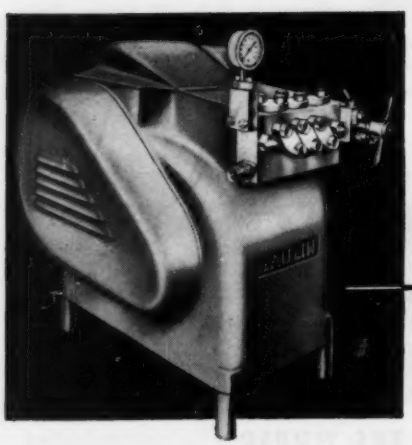
Gives smoother texture, longer shelf-life. Locks in perfume against evaporation.

**WAXES**
Makes accurate reproduceability possible. Provides uniform, stable emulsions and convenient viscosity control. Increases gloss.



**GAULIN PILOT PLANT HOMOGENIZER**
Ideal for experimental purposes, operation or process requiring up to 25 gallons per hour capacity. Handles quantities as small as one pint. Available on low rental basis.

**GAULIN TWO-STAGE COLLOID MILL**
Stator is jacketed for cooling or heating. Gap setting adjustable for .001" to .045". Only 45 seconds clean-up required in changing colors. 12" head room. 12" x 17" floor area.

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## HOMOGENIZERS

**WORLD'S LARGEST MANUFACTURER OF HOMOGENIZERS, TRIPLEX STAINLESS-STEEL HIGH PRESSURE PUMPS, AND COLLOID MILLS**

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# U.S.I. CHEMICAL NEWS

Nov.-Dec. ★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1955

## Polyethylene Coats Better When Applied As Liquid

High molecular weight polyethylene resins are reported to give excellent corrosion resistance when applied as coatings on metal surfaces.

Heat spraying equipment is available which reduces solid polyethylene to a low viscosity liquid before flame spraying so that coatings can be applied swiftly and uniformly at an average rate of 10 sq. ft. per minute. This method of application requires a target preheating temperature of 150-190°F, reportedly much lower than previous methods of application.

Resultant coatings meet strict U. S. Navy specifications for adhesion, porosity, corrosion, electrolysis, impact and thermal shock.

## *New AEC Sodium Handbook Now Available*

The third edition of the *Liquid-Metals Handbook* was released on July 1 of this year by the Atomic Energy Commission and Department of the Navy. Designated as the *Sodium-NaK Supplement*, it is devoted entirely to liquid sodium and liquid sodium-potassium mixes (NaK). Subjects covered include: chemical and physical properties; heat transfer and chemical engineering; system design; components; safety and fire protection; and applications.

Also available: *Sodium Plumbing* by William B. Cottrell and Leland A. Mann—a review of unclassified research and technology involving sodium at Oak Ridge National Laboratories.

These books are highly recommended as supplements to U.S.I.'s own literature on handling of metallic sodium.

## New Reforming Unit Assures Maximum U.S.I. Ammonia Production

At the U.S.I. ammonia plant — Tuscola, Illinois — a new Girdler reforming unit has just been completed as an alternate raw material source in the production of ammonia from natural gas. Until now the only raw material for U.S.I. ammonia manufacture has been hydrogen from the neighboring ethylene production facilities of subsidiary National Petro-Chemicals Corporation.

The new unit will supplement the available hydrogen when necessary to make it possible to operate the ammonia plant at full capacity at all times. This plant is rated at 50,000 tons per year.

## Alkali Metals On Agenda At Spring ACS Meeting

A symposium on the "Handling and Uses of the Alkali Metals" is scheduled for the national spring meeting of the American Chemical Society in Dallas, April 9-13, 1956. Metallic sodium, potassium, lithium, etc. will come under discussion.

# U. S. I. OPENS TWO NEW ALCOHOL DENATURING, DISTRIBUTION PLANTS

### New Units At Newark, N. J. and Tuscola, Ill. Also Serve As Distribution Points For U.S.I. Solvents and Chemicals

Two new combination ethyl alcohol denaturing plants, bonded warehouses, and solvent distribution points have been added by U.S.I. during the past month. One is at Tuscola in central Illinois, the production point for U.S.I.'s synthetic alcohol; while the other at Newark, N. J., replaces a smaller denaturing operation a short distance away. These new plants, along with existing units at New Orleans, La., Anaheim, Cal., and Chicago, Ill. permit overnight and often same-day emergency deliveries to alcohol and solvent users throughout most of the country. Integrated facilities at all locations can supply pure alcohol, denatured alcohol, SOLOX® proprietary alcohol solvent as well as other chemical solvents, in straight deliveries or mixed shipments in compartment tank cars, tank trucks, box cars and trucks.

The Newark plant has a 10 million gallon per year rated capacity, and is designed to handle the large tank truck volume in metropolitan New York and Northeast U. S. areas.

The Tuscola unit, designed to serve the Midwest with a flexible 12 million gallon per year capacity, is in the existing U.S.I. plant area where sulfuric acid, ammonia and nitrogen fertilizer solutions are produced. It is located next to subsidiary National Petro-Chemicals' manufacturing facilities for synthetic alcohol, ether, ethyl chloride, polyethylene and other petrochemicals.

Because these plants handle all denatured alcohol formulations, physical layout of the plant insures that only the required denaturants are present in any batch. This is accomplished by providing a separate line for each denaturant, and the use of 12 denaturing tanks. Gravity flow system insures complete

MORE

## U.S.I. Offers Premixes, Feed Formulation Help

To keep pace with increasing demand of feed manufacturers for premixes, U.S.I. has expanded the scope of its nutritional services.

Vitamin and antibiotic supplements are usually added to the ration in small amounts — a time-consuming operation demanding careful attention, where slight measurement errors can prove costly. As a result, more and more feed manufacturers are buying USIMIX Premixes which contain vitamins, antibiotics, methionine and other additives in batch-size packages mixed to their specifications.

Also available: U.S.I. formulation service, offered to feed manufacturers on a confidential basis. U.S.I. will review feed formulations and offer suggestions.

New U.S.I. alcohol denaturing and distribution plant at Newark, N. J.

Nov.-Dec. ★ **U.S.I. CHEMICAL NEWS** ★ 1955

CONTINUED

## Alcohol Units

drainage of all tanks and discharge lines. But with all of these built-in safeguards, chemical analysis of each batch is the final test. Years of application in other U.S.I. denaturing plants have proved the effectiveness of these methods of control.

Both plants have been designed to meet the pace of the fast-moving alcohol industry. Push-button control of the denaturing operation from a central control room permits quick preparation of formulas. Paper work delays are avoided by teletype connections between each plant and the U.S.I. sales divisions, a system which insures the best possible service for U.S.I. alcohol and solvent customers whose requirements were the governing factor in the design of these plants.

## Permits, Bonds No Longer Needed On Sodium Ethylate

Purchasers of U.S.I. alcoholic solutions of sodium ethylate (15-20%) no longer need to file permit form 1485, nor do they need bonds to cover such purchases. The product can be sold only to firms using it in chemical processes and such firms will be required to submit to A&TTD, for approval, Form 1479-A in quadruplicate, stating the process and recovery and reuse of the alcohol.

Sodium ethylate is made by reacting sodium metal with anhydrous ethyl alcohol. U.S.I. supplies finished product and both raw materials.

## "U.S.I. Isosebacic" Acid First Project For New Cincinnati Pilot Plant

U.S.I. has just completed a new half-million-dollar pilot plant building at its research site in Cincinnati, Ohio. The new building provides 15,000 sq. ft. of versatile plant space, air-conditioned control laboratories, and the necessary utilities for final testing of processes and products developed by the U.S.I.-National Distillers Research Department.

The research program is aimed particularly at the development of new products and processes which integrate with other industrial chemicals produced by U.S.I. and subsidiary National Petro-Chemicals Corporation. First product to be piloted in the new research building is "U.S.I. Isosebacic" acid, which exemplifies this research goal in that it is derived from both sodium and petrochemical sources. Evaluation quantities of the new material will be turned out, and the process, originally piloted at another location, will be polished up. Samples are now freely available to all interested researchers.

Preliminary work indicates that polyurethan flex-foams will provide a major outlet for this new dibasic acid. When made from "U.S.I. Isosebacic" acid, these materials seem to have more uniform cellular structure and excellent elasticity.

In the vinyl resins field, evaluations of compounds plasticized with esters of "U.S.I. Isosebacic" acid show an unusually high resistance to extraction by soapy water and oil.

National Distillers research laboratories in Cincinnati, O. New pilot building at right rear.

## TECHNICAL DEVELOPMENTS

*Information about manufacturers of these items may be obtained by writing U.S.I.*

**New alkaline agent for stripping** anodic coatings from aluminum eliminates waste disposal problem metal finishers encounter with acids. Water solutions at room temperatures remove average coatings by immersion only, in seconds. **(No. 1120)**

**Spiral polyethylene tower packings** now available show 140% increase in efficiency over other types, reduce packed height needed for separations. Liquid is held in interstitial spaces rather than on wetted surfaces. **(No. 1121)**

**Edible gum for thickening water** is now offered which gives viscosity of 3000 cp at 1% concentration, provides colloidal stabilization. One cent worth per pint makes a barely pourable solution, tasteless and odorless. **(No. 1122)**

**New folder describes** Flexspout® polyethylene closures on 5-gallon drums of U.S.I. ethyl alcohol USP, and U.S.I.'s proprietary denatured alcohol solvent SOLOX®. Illustrates how spout can best be opened and used. **(No. 1123)**

**New organic brominating agent** with 54% minimum bromine content now in commercial production. Costs less than other types, is somewhat more stable, and more reactive due to higher solubility in many organics. Gives high yields. **(No. 1124)**

**Entirely new type of adhesive** can be permanent or temporary, depending on requirements. Used for labeling polyethylene and other plastics, it replaces pressure-sensitive labels, can be applied by brush or existing machines. **(No. 1125)**

**Specimens of 25 starches and condiments,** on microscope slides, now available as standards in examining foods — and for quality control, research, litigation and criminology purposes. Hair and fiber specimens also available. **(No. 1126)**

**Newly developed paper admits air,** but resists passage of oil, water and other liquids. Manufacturer working on use possibilities. One suggestion — paper raincoats to shed water but keep wearer cool on hot days. **(No. 1127)**

**New patent on sodium** for making sodium cyclopentadiene listed as one of group of Ziegler patents on metal-organics now purchasable in translation. Patent gives 10 examples of convenient manufacturing procedures in detail. **(No. 1128)**

**A polyethylene sink trap** has been designed for laboratory use. This plastic resists acids, alkalis, fluorides and other chemicals; is physically tough and flexible. No tools required for installation, removal or replacing. **(No. 1129)**

## PRODUCTS OF U.S.I.

### ALCOHOLS:

**Ethyl Alcohol (Ethanol)**—Specially denatured—all regular and anhydrous formulas. Completely denatured—All regular formulas for industrial use, anti-freeze. Pure alcohol—USP 190°—Absolute, N.F., taxfree, taxpaid.

**Butanol (Normal Butyl Alcohol)**—Latent solvent for nitrocellulose, solvent for ethyl cellulose, many resins, many chemical syntheses.

**Amyl Alcohol, Refined**—Fine chemicals, pharmaceuticals.

**Fusel Oil, Refined**—Blend of amyl alcohols refined by chemical treatment, distillation.

**Proprietary Denatured Alcohol Solvents**

**SOLOX®**—General-purpose.

**FILMEX®**—Special, authorized for certain industries.

**ANSOL® M**—Anhydrous, special blend for lacquers, resins, etc.

**ANSOL® PR**—Anhydrous, special blend with higher ester content and solvency for lacquers, resins, etc.

### OTHER PRODUCTS:

**PETROTHENE® Polyethylene Resins.**

**Inorganic Chemicals:** Ammonia, Caustic Soda, Chlorine, Metallic Sodium, Sodium Peroxide, Sulfuric Acid.

**Esters, Ethers and Ketones:** Normal Butyl Acetate, Dibutyl Phthalate, Diethyl Carbonate, Diethyl Oxalate, Ethyl Acetate, Ethyl Ether, Acetone.

**Intermediates and Fine Chemicals:** Acetoacetarylides, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Sodium Oxalacetate, Sodium Ethylate solution, Urethan USP (Ethyl Carbamate).

**Animal Feed Products:** Calcium Pantothenate, Choline Chloride Products, Curbay B-G® 80, Special Liquid Curbay®, DL-Methionine, Niacin USP, Riboflavin Concentrates, Vitamin $B_{12}$ and Antibiotic Feed Supplements, Vacatone® 40, Vitamin A, $D_2$ and $K_3$ Products.

**Pharmaceutical Products:** DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.

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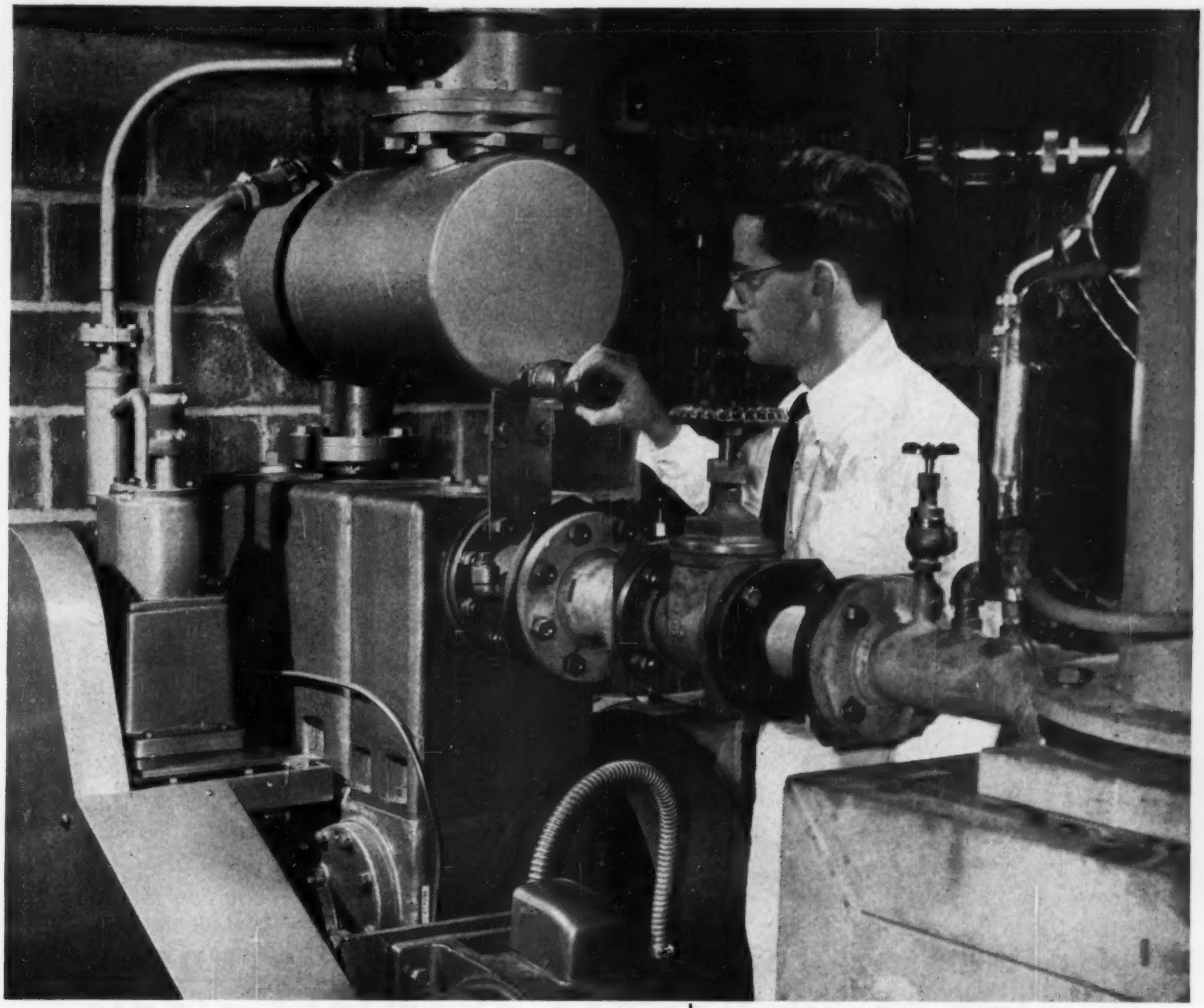

This is the NRC Rotary Gas Ballast Combination Pump Model NRC 200M. Other single and compound units with capacities from 1¼ to 400 CFM; blank-offs down to $5 \times 10^{-5}$ mm. Hg.

# Here's the Only Vacuum Pump Proved to Pump Water Vapor, too!

On just one humid day a mechanical vacuum pump may be asked to digest moisture-laden air containing over two gallons of water. If this or any other vapor is allowed to condense in the pump oil, pump down cycles become longer and longer and longer — a real production "headache". An oil change, a costly and time consuming operation, is required to restore pump efficiency.

Only NRC Rotary Gas Ballast Pumps have proved — on thousands of installations — that they keep their original high efficiency even when pumping troublesome vapors.

Here is the reason: only NRC pumps have been designed around the *gas ballast* principle, which, with other design features, prevents condensation ... keeps oil clean ... maintains original fast pump down time day after day. Send for Bulletin.

**SALES OFFICES**
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Please send me the NRC Rotary Gas Ballast Pump Bulletin.

Name_____ Title_____
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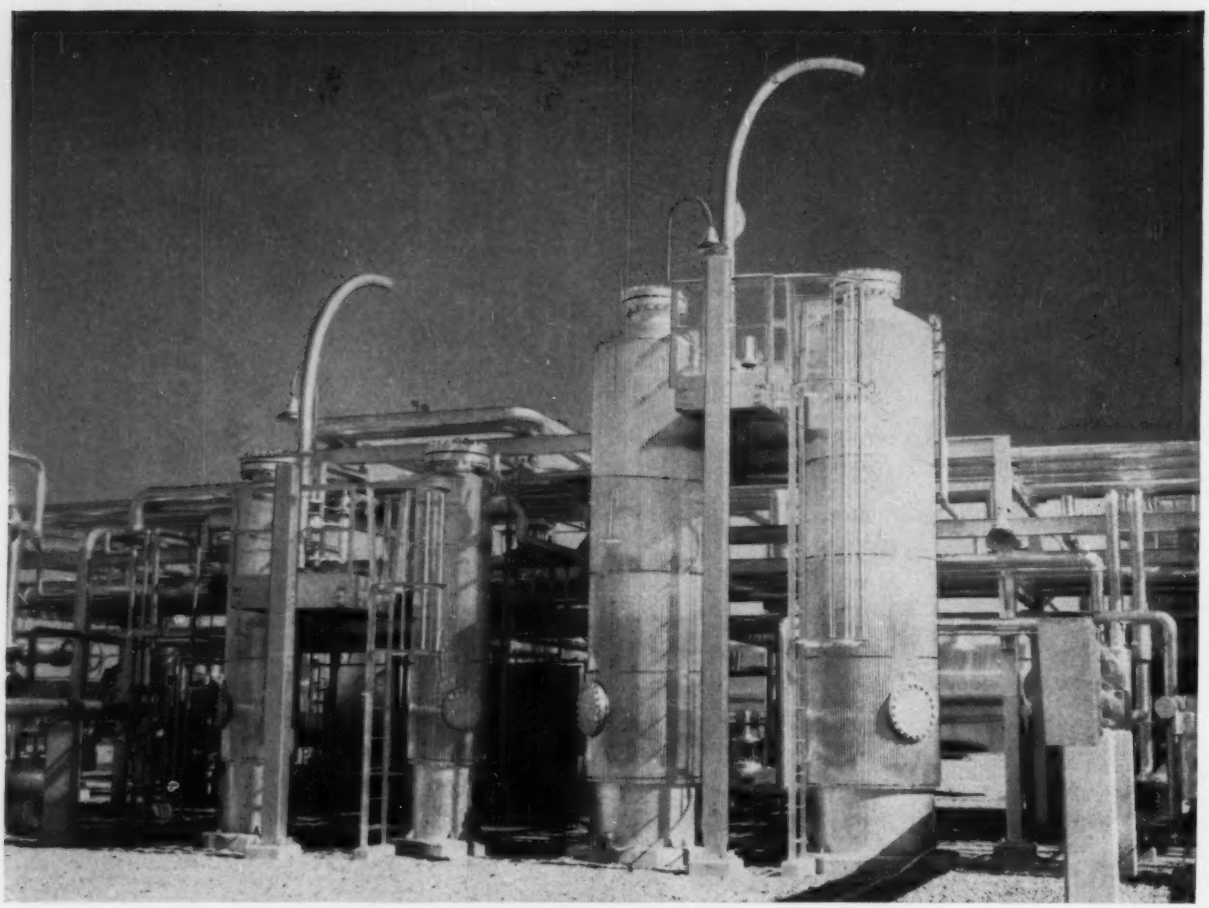


# Unibestos makes the big difference in pipe insulation for chemical plants

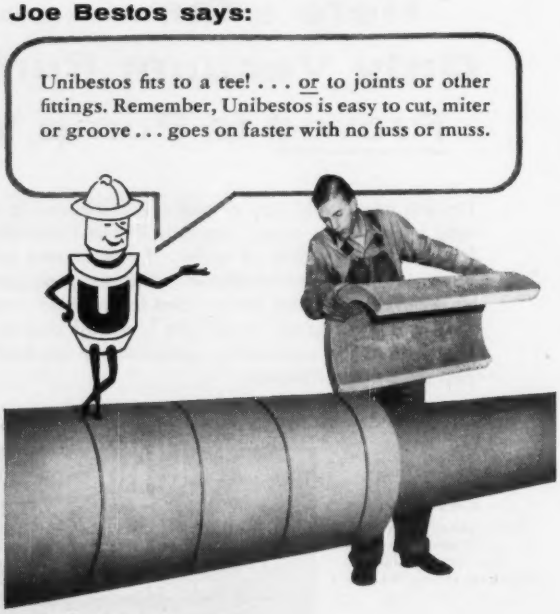
Not all pipe insulation is alike. There's a difference in insulating capacity . . . in durability . . . in ease of installation. And more and more chemical plants find Unibestos pays off on all three points. For Unibestos is made of Amosite, the long-fiber, quality asbestos that permits single-layer construction with superior insulating properties.

Single-layer Unibestos is easily installed right on the job. It's a strong, long-lasting insulation that withstands vibration and shock . . . resists moisture, steam, acid and chemical fumes. In fact, durable Unibestos is so durable that it can be removed and re-used many times over. Unibestos® pipe insulation is available in sectional form through 44″ O.D.

Write for **Free** descriptive Bulletin 109C.

UNARCO

**Joe Bestos says:**


Unibestos fits to a tee! . . . or to joints or other fittings. Remember, Unibestos is easy to cut, miter or groove . . . goes on faster with no fuss or muss.
U

**UNION ASBESTOS & RUBBER COMPANY**

1111 West Perry Street • Bloomington, Illinois

## THE UNIQUENESS OF DIATOMITE FILTERAIDS

**Paul W. Leppla, Technical Director**

The purpose of a filteraid is to sieve out suspended solids without plugging. Therefore, it follows that the porosity of the filter cake is an important characteristic. This is one of the several properties possessed by filteraids produced from diatomite (diatomaceous earth or DE) to a remarkable degree. Actually, diatomite filteraids form filter cakes consisting largely of space, since 85-90% of the volume of the cake is void space and unlike filteraids produced from cellular materials, almost all of the void space is available or useful.

Fine powders of siliceous materials often pack into a bed in such a fashion that the percentage of voids is close to 25%. Thus, 100 pounds of silica in the form of sand occupies about one cubic foot and provides 0.25 cubic foot void space.

In contrast, 100 pounds of processed diatomite filteraid develops over five cubic feet of filter cake, and provides about 4.5 cubic feet of void space for filterable solids. Diatomite filteraids thus offer 18 times the solids retention capacity of an equal weight of sand.

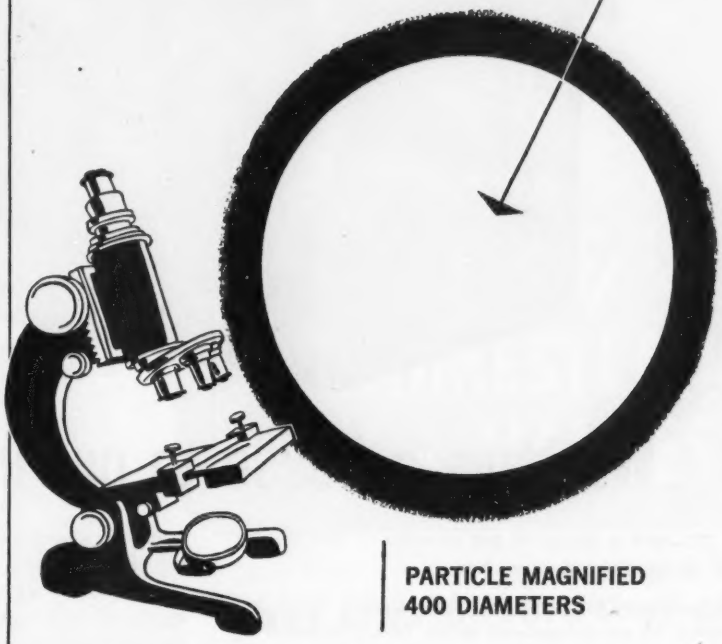
Let's calculate the theoretical filtration capacity of the two materials, using the assumption that filtration will proceed until the voids are completely plugged. Actually, this ideal case is never achieved, but the comparison between the two materials will still be valid.

If the liquid to be filtered contains 1% suspended solids by volume, the sand bed will filter 188 gallons before the void space is completely filled. The same weight of diatomite filteraid will filter 3,400 gallons on the same basis.

As a first approximation, or filteraid rule-of-thumb, the filtration engineer, lacking actual test data, will recommend the addition of diatomite filteraid at the same percentage as that of the suspended matter to be removed. On this basis, it is seen that the hypothetical liquor containing 1% matter as described above should require 1% filteraid. Our calculation shows 100 lbs. diatomite to 3,400 gallons of filtrate, or 0.37%. In plant practice, filteraid dosage often is well below the rule-of-thumb recommendation. This provides convincing evidence for the statement that nearly all the void volume in diatomite filter cakes is available or useful.

From time to time in the past, materials other than diatomite have been introduced as filteraids, often on the mistaken basis that low bulk density is the principal property required for success. The list of materials upon which ambitious plans have been made and have failed is long. A few filteraid adjuncts having special properties find limited utility in the process industries, but diatomite continues to be the outstanding raw material for filteraid manufacture.


# Dicalite Filteraids can filter out particles this small!



PARTICLE MAGNIFIED 400 DIAMETERS

That's right—you can't see it, even when magnified 400 times. The eye can detect, at 10″ distance, a particle 80 microns in size; hence, we're talking about particles smaller than .2 micron, down below the wave-length of visible light.

And Dicalite Filteraids are trapping and filtering out smaller particles than that, particles as small as .137 micron, particles visible only with the ultramicroscope or the electron microscope. Which explains why Dicalite Filteraids are so widely used in so many processes where thorough separation is imperative for purity and clarity. Write for further information.

Dependable GLC GREAT LAKES Dicalite® DIATOMACEOUS MATERIALS

DICALITE DIVISION • GREAT LAKES CARBON CORPORATION, 612 SOUTH FLOWER STREET, LOS ANGELES 17, CALIFORNIA

# We have a house to put in order...

WE HAVE A HOUSE to put in order . . . and it's the house where America lives.

Of our country's many million homes, more than 1 out of every 10 are out-and-out slums. Nearly one-half of all American dwellings are in poor to "fair" condition, and urgently need basic repairs.

Something *must* be done—both to correct the slums of today and *prevent* the slums of tomorrow.

How do slums start? Usually just one house starts to slide downhill and soon a whole block changes. Pride is lost. Other houses are neglected, decay spreads.

So the 20 million homes in need of basic repair and improvements deserve equal attention. The time to stop the spreading blight of slums is *before it starts.*

### What's your stake in stopping slums?

If you think your town is different, just look around you . . . If you think slums only affect persons who live in them, think again.

Slums raise taxes and lower property values of the whole town. They raise rates of crime, delinquency and disease. *Everyone* has a real stake in stopping slums. And *that includes you as a businessman.*

Your firm is certainly dependent on the welfare of the community where you do business. But it's more than good business—it's good citizenship to take part in efforts aimed at civic improvements. It's the *responsibility* of every business.

**What can your firm do?** The answer to America's housing problems starts with individuals. But to roll back slums is such a big job it's going to take more than individual effort. It will need the cooperation of your business and many others.

Some slums should be torn down and a fresh start made. Others can be remodeled and made to conform to better living standards. So it is up to you to support every sound program which seeks adequate housing for all our people.

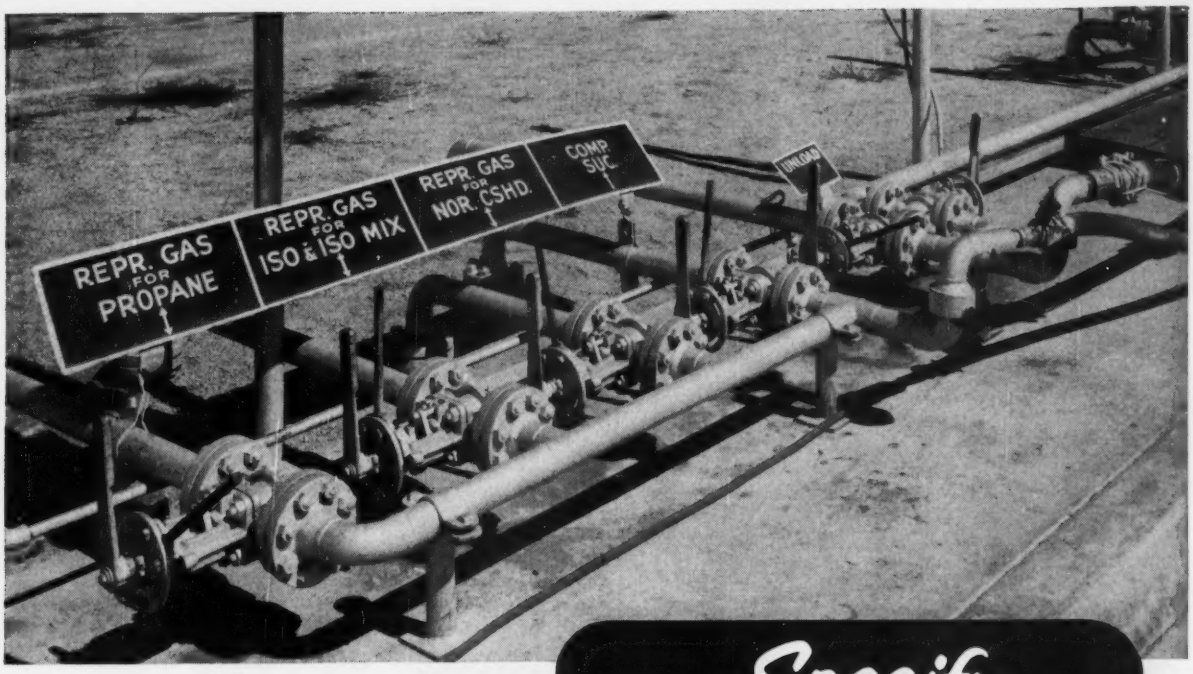
### New help is now available

There is a new national, non-profit organization called A.C.T.I.O.N.—The American Council To Improve Our Neighborhoods—which is designed to help all individuals or groups interested in putting America's house in order.

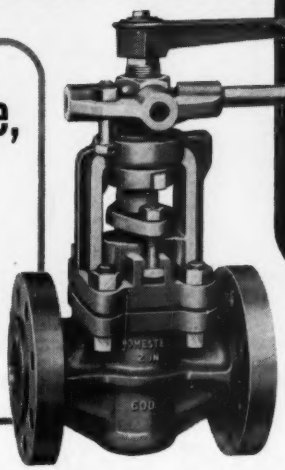
Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It lists booklets, research, check-lists, and other material which can help you. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American Council To Improve Our Neighborhoods




for dependable, trouble-free control of "hard-to-hold" fluids . . .



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## they provide sure shut-off...

### ARE STICK PROOF...OPERATE INSTANTLY

A positive, drop-tight seal and instant, stick-proof operation under all fluid, temperature or pressure conditions, is assured by the exclusive, built-in, Homestead Lever-Seald mechanism. This powerful lever-and-screw device not only presses the valve's tapered plug firmly into its seat to form a drop-tight seal, but also provides a positive means of relieving seating pressure just enough to overcome friction and permit easy operation. And because all operating parts and valve seating surfaces are fully protected in both the open and closed positions from the corrosive or erosive effects of line fluids, long, dependable, trouble-free service is doubly assured.

If "hard-to-handle" fluids are your problem, specify Homestead Lever-Seald Valves for your next installation or as replacements. You'll be glad you did.

We make them in metals and alloys to specification in sizes 1½" to 12", for pressures from vacuum to 1500 lbs., and for temperatures from 40° below zero to 1100°F. Dry seat, or pressure gun lubricated optional.

**For complete details and copy of VALVE REFERENCE BOOK No. 39-3, MAIL THE COUPON TODAY.**

Without obligation, send me Catalog 39-3 covering Homestead Lever-Seald Valves.

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**VALVE MANUFACTURING COMPANY**
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P.O. BOX 13 CORAOPOLIS, PA.

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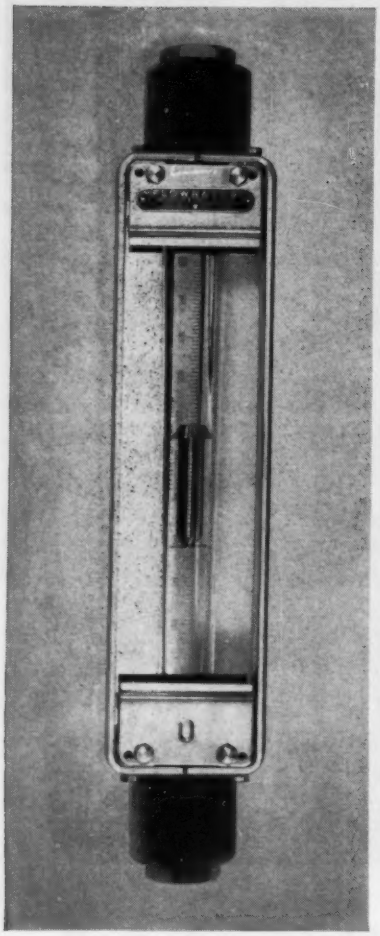
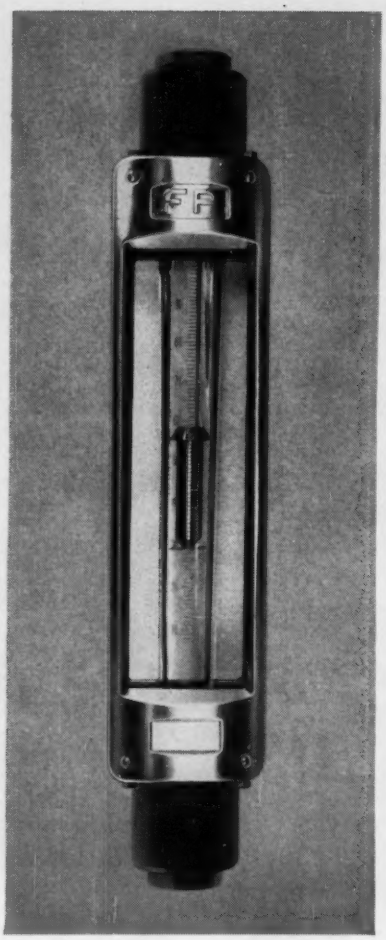
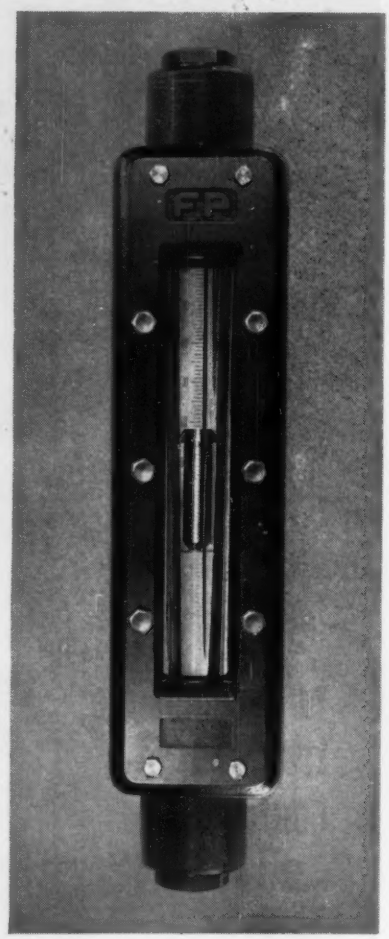


SIDE PLATE FLOWRATOR METER



ENCLOSED FLOWRATOR METER



PRESSURE SEALED FLOWRATOR METER

# A proven veteran with greater strength and a new dress uniform

**Fischer & Porter's New 1700 Series Flowrator Meter**

F&P has taken its proven 700 Series Flowrator Meter, kept the inherent good features, increased its strength and flexibility, and presented it in a new modern case. This improved instrument, the 1700 Series Flowrator Meter, retains the same over-all dimensions, the same proven universal end fittings, the same wide selection of interchangeable tube float and packing combinations. This permits immediate substitutions for any existing 700 Series meter installations without costly pipe changes.

These are the added features—

- Basic design allows for 3 types of construction from same frame
- Sturdier and safer construction
- Greater visibility of the meter (over 100% more vision)
- Built-in panel mounting fittings
- Stainless steel enclosure
- Built-in safety features

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Measuring, recording and controlling instruments
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Industrial glass products

*Sales offices in 32 American cities and in principal cities abroad*

Come to Crouse-Hinds

# *for Complete Protection against*

# *Electrically-Ignited Explosions...*

**CONDULET® Explosion-Proof Electrical Equipment**

***for areas defined by the National Electrical Code as hazardous.***

Rigid Conduit Fittings
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A NATIONWIDE **DISTRIBUTION** exclusively through **ELECTRICAL DISTRIBUTORS**

No chain of explosion-proof electrical devices is stronger than its weakest link.

Crouse-Hinds – and only Crouse-Hinds – can provide positive protection *wherever* the merest spark can possibly occur in explosive atmospheres . . . from size 5 motor starters to sound-powered telephones. There are over 15,000 conventional and explosion-proof products in the Condulet line! They are available through your Crouse-Hinds distributor.

For further assistance on your explosion-proofing problem, just call the nearest Crouse-Hinds office listed below. Our field engineers are *electrical* engineers, fully qualified to make specific recommendations for your plant.

## CROUSE-HINDS COMPANY

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# he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

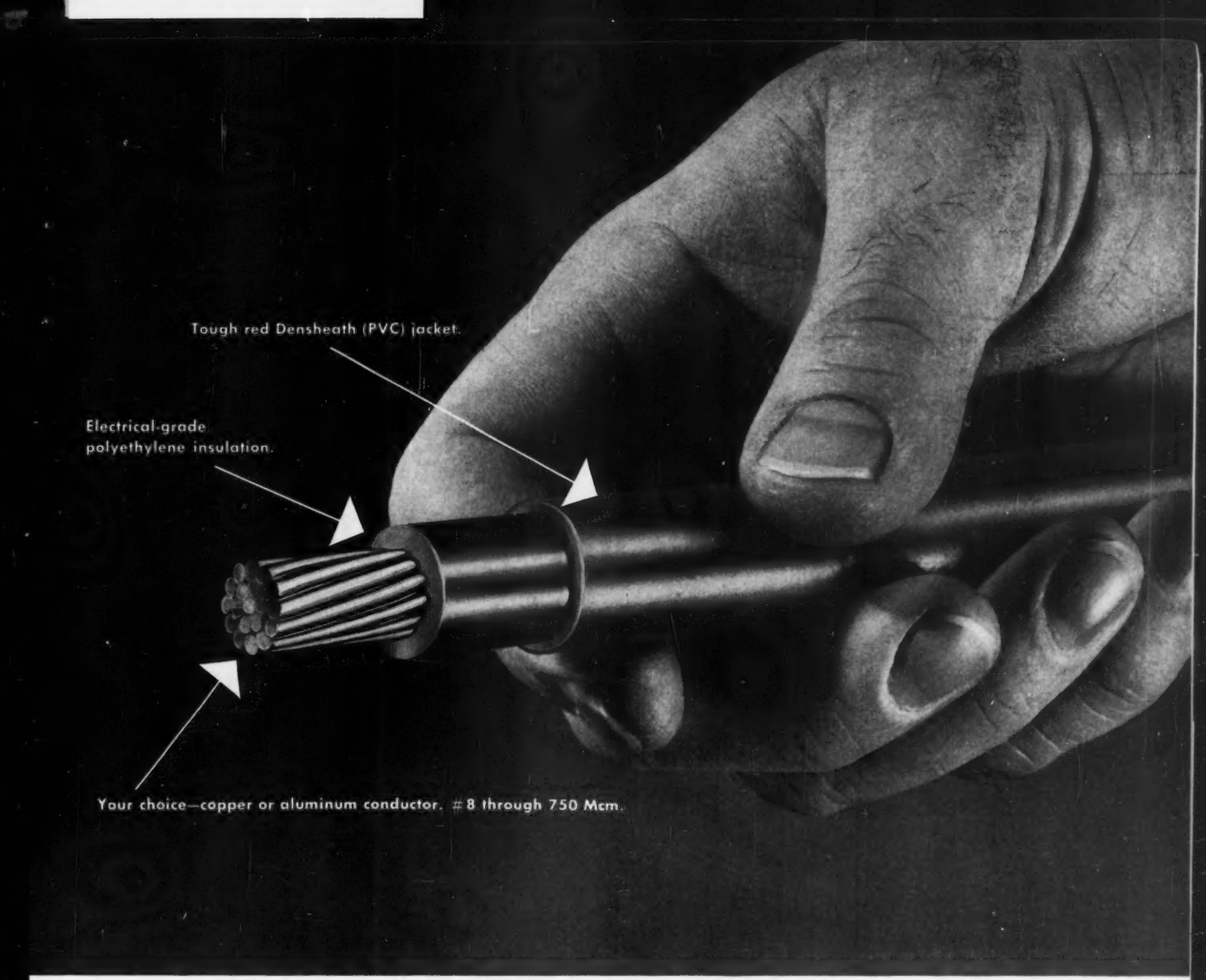
THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you—giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

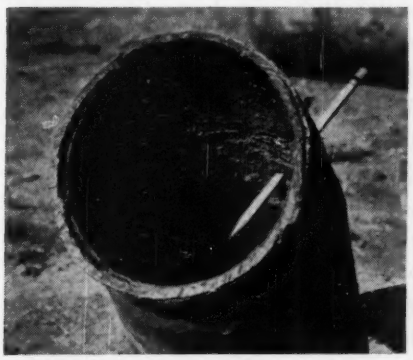
McGRAW-HILL FOR BUSINESS

McGRAW-HILL PUBLICATIONS


Tough red Densheath (PVC) jacket.
Electrical-grade polyethylene insulation.
Your choice—copper or aluminum conductor. #8 through 750 Mcm.

# Here's why Anaconda's new Type CP Cable lasts far longer in Cathodic Protection

**Cathodic Protection demands a special cable of its own. Anaconda's *Type CP Cable* offers top resistance to oil, soil acids, and electro-endosmosis . . . means *longer cable life*.**



**A pencil pokes through** this corroded metal! Why chance trouble like this? Cathodic Protection and Anaconda Type CP Cable effectively check corrosion of buried metals.

Ordinary rubber cables – good as they are for the jobs for which they were *intended*–just can't give best service under the special conditions of cathodic protection.

Unless cables are *designed* to combat endosmosis‡–plus moisture, oil and soil acids–they just won't do.

But now Anaconda offers a special Type CP Cable–that *lasts far longer* than ordinary cable in cathodic-protection systems.

High-grade polyethylene insulation and tough Densheath* (PVC) jacket offer amazingly high resistance to electro-endosmosis, as well as high resistance to oil, moisture, and most acids, alkalies and chemicals found in corrosive soil areas. And rugged Densheath withstands toughest abrasion, moisture and weathering.

To order, or for more information–call the Man from Anaconda. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 55342

*Reg. U.S. Pat. Off.

‡*Insulation failure when subject to d-c potential in wet locations.*

**ANACONDA®**

**CATHODIC PROTECTION CABLE**

*The National Merit Scholarship Corporation*

# Business is Offered Big Dividends on Investment in Higher Education

**The McGraw-Hill Publishing Company is availing itself of the opportunity to establish ten National Merit Scholarships. They will be known as the McGraw-Hill Merit Scholarships. The scholarships are to be awarded to qualified candidates for a four-year college course in the fields of science, engineering and the other professions and the liberal arts. There will be no limitation, beyond the appropriate professional accrediting, on the college or university selected by a successful candidate. As part of a continuing program to aid higher education and educational institutions, McGraw-Hill is happy to be able to share in what it believes to be the constructive educational endeavor of the National Merit Scholarship Corporation.**

Business firms searching for a satisfactory avenue to provide financial aid for our colleges and universities now have a new opportunity of major importance. It is provided by the National Merit Scholarship Corporation, which has offered to devote $8 million to matching, dollar for dollar, gifts by business firms for college scholarships and supplemental gifts to the institutions where the scholarships are used.

The National Merit Scholarship Corporation, an independent agency financed initially by gifts of $20 million from the Ford Foundation and $500,000 from the Carnegie Corporation, has three major purposes which are closely related. They are:

1. To locate those of the nation's young men and young women who are best equipped to go to college.

2. When necessary, to help these young people go to college by giving them financial aid.

3. To help colleges and universities meet the full cost of the instruction of those to whom National Merit scholarships are granted.

At present about half of the nation's top high school graduates do not go to college. The principal reason is that they do not have the money required.

## To Save Unused Brain Power

The National Merit Scholarship Corporation will strive to eliminate this dangerous neglect of top-flight ability. To this end it is inviting the nation's high schools, numbering more than 24,000, to participate in its program by designating as available candidates for National Merit scholarships the top 5 percent of their senior classes. Those so designated are then invited to take a series of tests and to submit reports designed to assure selection of the very best talent in each state. The number of scholarships to be allotted to each state will be proportionate to the number of high school graduates in the state.

The winners, the total number of whom will be determined by the amount of money the Scholarship Corporation has available, will be eligible for awards. For those who need no financial help to go to college there will be honorary awards of $100. For those who must have help the Corporation will grant scholarships covering as much as necessary

of the cost of instruction and living expenses for a four-year college course.

## Colleges Get Financial Help

The provision of funds to cover the students' expenses does not, however, solve the financial problems faced by many colleges. That is because the tuition charges paid by the students do not cover the cost of the instruction. The deficit must be met by drawing upon endowment funds, gifts, grants, and other available sources.

Consequently, to prevent holders of National Merit scholarships from imposing any additional financial burden on the colleges and universities they elect to attend, the Corporation will make a supplementary grant to these institutions. The supplementary grant will be the equivalent of regular tuition charges made by the school, with a top limit of $1,500 a year for both the tuition and the supplement.

As the scholarship grants to the winning students will vary, depending upon how much financial help they need, so will the supplementary grants vary from one college to another, depending on their regular tuition charges. However, it is anticipated that on the average the full cost of a National Merit scholarship—including aid to the student and the supplement to the college—will be about $1,500 a year.

Many business firms will find a compelling appeal in a program which is designed at once to mobilize the nation's intellectual resources more effectively and, in the process, give very badly needed financial help to our colleges and universities.

## Two For One Return Offered

However, there are numerous other inducements to business firms to finance National Merit scholarships. These scholarships may:

1. Carry the name of the firm or be named in honor of someone designated by the firm.
2. Be limited to use in types of colleges of particular interest to the sponsoring firm.
3. Be limited to a college course, such as science, engineering or liberal arts, of special concern to the sponsor.
4. Be restricted to candidates or institutions in geographic areas specified by the sponsor.

In addition to these advantages there is a special financial inducement to help the Merit Scholarship program. It is that for every Merit scholarship a firm or individual finances, the Corporation will, up to the limit of $8 million, match the funds and make another National Merit scholarship available.

There are many good ways of helping our financially beleaguered colleges and universities, and many corporations are already using one or more of them.* For those companies that can do so without embarrassing complications one of the best ways is to make unrestricted gifts directly to the institutions. But this new way provided by the creation of the National Merit Scholarship Corporation (Address: 1580 Sherman Avenue, Evanston, Illinois) has the broad appeal of serving two purposes of transcendent importance simultaneously. The purposes are to see that our best brains are fully trained and utilized and that our colleges and universities, crucial contributors to this process, are helped at the same time. Business will serve the nation and its own community well by giving the National Merit Scholarship Corporation generous help.

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* These, as well as the plight of our colleges and universities, are discussed in a pamphlet, "Business Aid to Our Colleges and Universities," which embodies a series of five editorials which appeared in all McGraw-Hill publications. Copies of the pamphlet can be obtained without charge by addressing the Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, New York.

Methods of helping our colleges and universities financially are also outlined and discussed in a pamphlet, "Aids to Corporate Support of Higher Education," which may be obtained without cost by addressing the Council for Financial Aid to Education, 6 East 45th Street, New York 17, New York.

*This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.*

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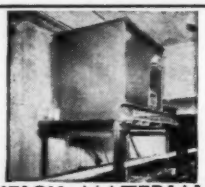

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We Buy and Sell Complete Plants or Single Items

CALL, WIRE WRITE, YArds 7-3865

NEWMAN TALLOW & SOAP MACHINERY CO. INC.
ESTABLISHED IN 1880
1051-59 WEST 35TH STREET
CHICAGO 9, ILLINOIS


# SEARCHLIGHT SECTION

*(Classified Advertising)*

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

***UNDISPLAYED*** —RATES— ***DISPLAYED***

$1.80 a line minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

The advertising rate is $16.95 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

*Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. for December issue closing November 3rd*


ROTARY DRIER. Countercurrent, stainless steel. Drum 3' by 18'. Complete accessories including: drive, steam coils, blower cyclone, feed metering device, conveyors, feed and product hoppers. New in 1952. Price $6000.

BUFLOVAK DOUBLE-DRUM DRIER, 42" by 120". Complete, with Fitzpatrick Comminutor Model "M", stainless.

TEN PFAUDLER GLASS-LINED TANKS @ 3000 gal. Horizontal, insulated, sanitary construction. With agitators, motors and thermometers. Only $250.—ea.

BUFLOVAK EVAPORATOR, single-effect, stainless, sanitary, 196 sq. ft.

YALE ELECTRIC FORK TRUCK Model M25TTF with battery and charger, used one year.

YALE HAND LIFT TRUCK for pallets, Model J-20P. Also, HAND LIFT TRUCK for skids.

**MAPLE LEAF MILK CO.**
Neenah, Wisconsin.
Phones: PA 2-4503 & PA 2-2363.



**BIG SAVINGS IN GUARANTEED EQUIPMENT**

**DRYERS & KILNS**
Devine #12 & #23 Vac. Shelf Dryers.
1—Stokes 2' x 6' Rotary Vac. Dryer.
2—Albright-Nell 4' x 9' Atmos. Drum Dryers.
1—Buffalo Vac. Drum Dryer 24" x 20".

**CENTRIFUGALS & CENTRIFUGES**
4—Tolhurst 40" Suspended Type Centrifugals.
8—Centrifugals 12", 30", 40" & 48" Steel, Copper, Stainless & Rubber Lined.
6—Sharples Centrifuges #5A Stainless. Also #6.
3—De Laval Multiple Clarifiers #200, 300 & 301.

**FILTERS**
#2 Sweetland Filter 12 Stainless Covered leaves.
1—Vallez 41 Stainless Covered Leaf Filter, type 49.
Sperry & Shriver 12" to 36 sq. iron & wood.
Gen. Amer. 2' x 1' Rotary Vac. Filter.

**KETTLES & TANKS**
Pfaudler 250 & 500 gal. Glass Lined Kettles.
1—Dopp 350 gal. C.I. Jack. Vac. Kettle.
Devine & Stokes Impreg. Units 30" & 36" dia.
Devine 1000 gal. closed Jack. Steel Kettle.
1—2300 gal. vert. agit. Jack. Steel Kettle.
8—Jacketed Kettles 50 to 2300 gals.
1—250 gal. Lead-Lined Kettle.
2—800 gal. vert. Glass Lined Tanks.
50—Stainless Alum., Copper, Glass & Lead Lined Kettles & Tanks. Also new Stainless

**PULVERIZERS & MILLS**
3—Mikro Pulverizers #2SI, #2TH.
Patterson 30" x 42", 4' x 5' & 6' x 4' Pebble Mills.
Abbe 30" x 30" & 5' x 6' Pebble Mills.
Abbe 37" x 30" Chrome Mang. Lined Ball Mill.
#1 Raymond Automatic Pulverizer 20 H.P. motor.
1—Raymond #00 Pulverizer 30 H.P. Complete
2—#0000 Raymond Mills.
Sturtevant #0,18" Hinged Hammer Mill.
Jeffrey 18" x 18" Single Roll Crusher.
Buchanan 5" x 12" Jaw Crusher.
Day Hercules Spike Crusher 1½ HP. motor.
Hammer Mills & Pulverizers 3 to 50 H.P.
1—Schutz-O'Neil 20' Pulverizers. Also #1.
Williams #3 & 2xx Hammer Mills.
1—Robinson 18" x 22" Attrition Mills.
1—Lehman 4 Roll W.C. 12 x 36" Steel Mill.
3—Steel 3 Roll Mills 9"x32", 12"x30" & 16"x40".
3—Houchin 18"x36"; 4 Roll Granite Stone Mills.
Ball & Jewell Rotary Cutters Lab. #1 & #2.
2—U. S. & Premier 1½ H.P. Colloid Mills.

**MIXERS & SCREENS**
Lancaster 6' dia. Vert. Mixer 25 H.P.
Baker Perkins double arm 100, 50 #9 gals.
2—Read 50 & 100 gal. double arm mixers.
Kent 3 HP. Continuous Dry Mixer.
Horiz Mixers single & double arm to 200 gal.
3—Day 8, 15 & 40 gal. Pony Mixers.
2—Day Brighton 20 gal. Change Can Mixers.
Read 40 and 80 qt. vertical Mixers.
6—Lead — Paste Mixers 50 to 150 gals.
Tyler 3'x5' Vibratory 2 Deck Screen. Other sizes.
Blystone 3000# horiz. spiral mixer.
10—Dry Spiral Mixers 50 to 3000#.
12—Portable Elec. Agitators ¼ to 3 H.P.

**MISC. & SPECIAL**
Banbury size B lab mixer.
Thropp 3" x 8" Lab. Rubber or Plastic Mill.
Kux 2½" single punch Preform Machine.
Belt Conveyors 12', 15' & 20' long.
Anderson & French Oil Expellers.
Gould 75 HP Centrifugal Pump. 250 PSI.
1—Marco 200 Stainless Steel Homogenizer.
Filling Machines powder, paste & liquid.
Rotary & Single Punch Tablet Machines, ½" to 4".
1—Howe Mogul Barrel & Bag Packer.
2—Worthington 12" x 12" x 12" Vac. Pumps.
6—Devine Stokes & Buffalo Vac. Pumps.
Soap Machinery for Toilet, Laundry, Chip, Liquid.
Plastic & Rubber Mills, Calenders, Hydr. Presses.
Inject. Mold Equipt. Extruders, Banbury Mixers.

NEW TANKS, STAINLESS & CARBON STEEL, BUILT TO YOUR SPECIFICATIONS
WE BUY YOUR SURPLUS MACHINERY & COMPLETE PLANTS
PARTIAL LISTING, WRITE FOR BULLETINS

**STEIN EQUIPMENT COMPANY**
107 - 8th St., Brooklyn 15, N. Y. *Sterling 8-1944* *Cable Macheguip*



AVAILABLE
WANTED

**CUSTOM REFINING FACILITIES . . .**
- Complete Distillation Service
- Distillations
- Extractions
- Fractionations
- Drum Lots—Tank Cars
- All Types of Crude Mixtures
- By-Products, Residues, Wastes
- Contaminated Solvents

*Trufland* CHEMICAL & ENGINEERING CO., Inc.
Box 426, Union, N. J. MUrdock 6-5252



Box 426, Union, N. J. Murdock 6-5252



**FOR SALE**

18—Jeffrey Mfg. Co. Power Units for tubular vibrating conveyor capable of conveying 40 ton per hour of 105 pound/cu. ft. material. No. 4M1 for 440V., 60 cycle, mixed current operation, 72 amps maximum. Serial numbers 21527, 21532. Used 6 months only—in good condition. If interested, contact Purchasing Department, Mutual Chemical Division, Allied Chemical & Dye Corporation, 1348 Block Street, Baltimore 31, Maryland. Subject to prior sale or use.



**WANTED TO BUY**
**ROTARY KILNS**
**9' x 150'**
**8' x 80'**
**OR LARGER**

PRODUCERS SUPPLY AND ENGINEERING COMPANY
4226 S. LAWNDALE AVE.
LYONS, ILLINOIS
PHONE: LYONS 3-4526



**WE NEED**
**All Kinds of Oil Refinery and Chemical Equipment, also Tanks**
Write — Wire — Phone
Weinstein Co., Div. of Surplus & Salvage Co., Inc.
810 West 8th Street Jamestown, New York

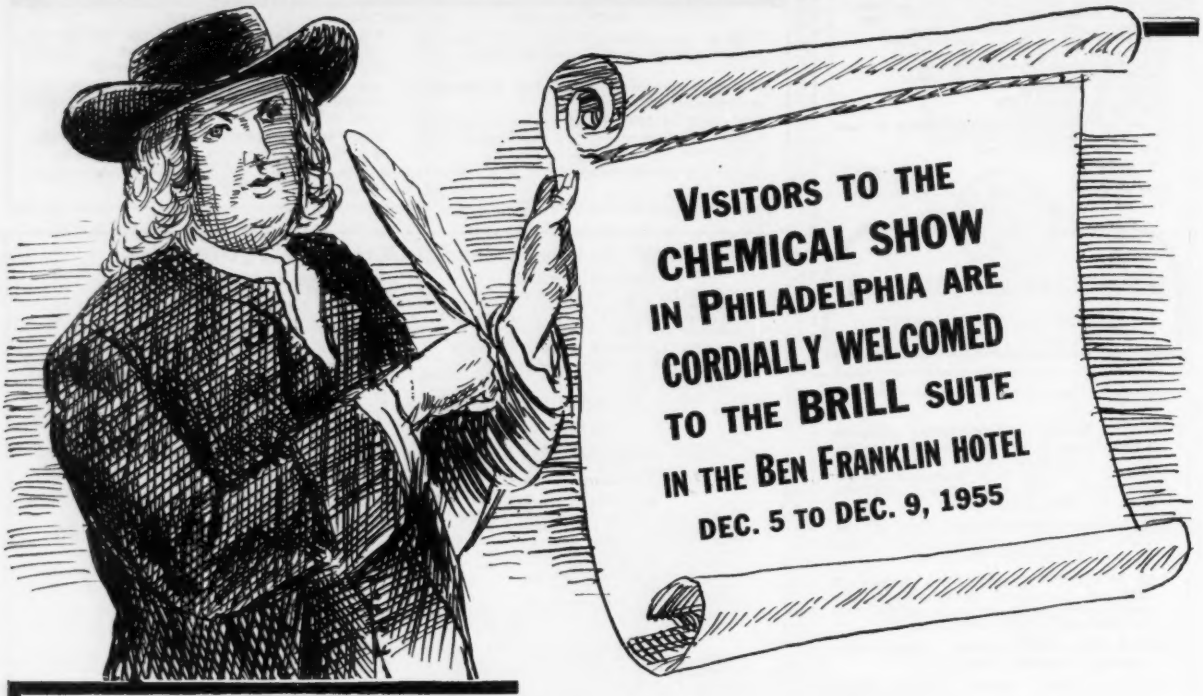


**WANTED—SURPLUS**
**Chemicals—Dyes—Drugs**
**Colors—Pigments—Oils—Waxes**
**By-Products—Wastes—Equipment**
**CHEMICAL SERVICE CORP.**
80-04 Beaver St. New York 5, NY



***— WANTED —***
**SURPLUS LOTS**
***VALVES & PIPE FITTINGS***
**Unused — Any Type — Any Quantity**
***PRUDENTIAL PLUMBING PRODUCTS***
Foot of Centre Street Newark 2, N. J. MArket 4-2277

# Be With BRILL . . .




## LIQUIDATIONS

### LOUISIANA

1—I.R. Jet Refrigeration Unit complete 208 Tons 65.5°F to 60°F.
1—I.R. Jet Refrigeration Unit complete 136 Tons 50°F to 45°F.
1—Patterson 7'6" Conical Blender rubber lined.
1—Buflovak 6'x5'6" Monel Drum Flaker NEW.
1—Rietz 30' "Thermoscrew" Conveyor Dryer 304 S/S NEW.
1—Pfaudler 250 gal. Hastelloy "C" Reactor.
3—4'x13' closed 316 S/S Reactors, 109 3"6' 316 S/S tubes 150 psi.
1—2500 gal. 316 S/S jacketed Reactor.
1—Pfaudler 5'x18' Horiz. glass lined 2500 gal.
1—Pfaudler 78"x96" Vert. glass lined 2300 gal.
2—1500 gal. 316 S/S 5'x9' Vert. 20 psi.
1—7500 gal. 316 S/S clad 12'x6'x5'6" cone.
3—Link Belt 316 S/S 18"x12", 18"x10', 18"x7' twin screw Conveyors.

### TEXAS

19—715 sq. ft. S/S Atmos. Heat Exchangers.
6—477 sq. ft. S/S Atmos. Heat Exchangers.
350'-10" 347 S/S pipe Schedules 10 and 40.
68—8" and 10" flanges and Ells 347 S/S.
1300'-4" 347 S/S tubing ½" wall.
9000'-1" S/S tubing 14 and 16 gauge.
250—304 and 316 S/S Valves ½" to 4".
1—7'x30' Butane Tank 250# W.P.
2—10'x40' welded Tanks ⅜".
1—10'x30' welded Tank ⅜".
3—8'x12' Vert. 316 Stainless Tanks 120# at 1000°F.
12—2000 bbl. Storage Tanks.
9—5000 bbl. Storage Tanks.
1—6'x35' Steel Tower, 15 trays, 152#.
1—5'x96' Steel Tower, 40 trays, 135#.
1—30"x80' Steel Tower, 24 trays, 160#.
1—2'x40' Steel Tower, 22 trays, 150#.
1—20"x50' Steel Tower, 24 trays, 450#.
1—12"x30' Steel Tower, 14 trays, 120#.

### SPECIALS

1—Skinner 6' dia., 10 hearth Roaster.
1—5'x20' Baker Rotary Cooler.
1—8"x15" Pacific Jaw Crusher.
1—10,000 gal. Aluminum Tank ½" shell.
1—Oliver 8'x10' Monel Rotary Filter.
2—Rotary Dryers 8'x60', 6'x40'.
2—Sharples C-27, C-20 S/S Super-D-Hydrators.
1—5x15 Nickel Rotary Vac Dryer.
6—Stokes & Nat'l Research Vacuum Freeze Drying Cabinets with refrigeration and vacuum equipment.
6—30"x10' jacketed Spiral Mixers.
1—Day Jumbo jacketed Mixer 6'x12'.
1—Day Jumbo jacketed Mixer 6'x18'.
6—Pfaudler Reactors 150, 500 and 1000 gal.

*PARTIAL LIST ONLY*

***Details on request***

TEXAS OFFICE—4101 SAN JACINTO ST., HOUSTON 4, TEXAS TEL.: JACKSON 6-1351

**BRILL EQUIPMENT COMPANY**
2401 THIRD AVENUE, NEW YORK 51, N. Y.
*Telephone: CYpress 2-5703 • Cable: Bristen, N. Y.*

A SINGLE ITEM OR A COMPLETE PLANT

Write, wire or phone us for complete information — Send us your surplus equipment lists today

# at the Ben Franklin

## Here's part of the BRILL SHOW of Top Value Equipment

### DRYERS

1—Vulcan 8'x125' Rotary Kiln.
3—Vulcan 6'x40', 5'x40', 5½'x50'.
3—Link Belt 3'10"x12', 5'2"x20', 7'5"x 20' S/S.
4—Devine #27 double door Vacuum Shelf 17—59"x78" shelves.
1—Stokes #138-H Vacuum Shelf Dryer 10—44"x40" shelves.
2—Struthers-Wells 5'x15' nickel Rotary Vacuum.
1—Devine 5'x10' Steel Rotating Vacuum.
2—Stokes 30"x8', 3'x15' Rotary Vacuum.
1—Louisville 38"x25' Rotary Steam Tube.
4—Buflovak Double Drum 42"x120", 42" x100", 36"x84", 32"x72".
2—Buflovak 6' and 3' dia. Crystallizers.

### FILTERS

2—Oliver Rotary, Monel 8'x10', 3'x2'.
1—Feinc 5'x3' Monel, Rotary Vac String.
1—Feinc 3'x1', 316 S/S Rotary Vac String.
1—Swenson Rotary 4'x2' nickel.
1—Oliver 5'3"x3' rubber lined Rotary Vac Precoat.
2—Sweetland #12, 72 and 36 leaves.
4—Sweetland #3, #5, #7, #10.
2—Sweetland #3, S/S shell and leaves.
2—Niagara 53 and 110 sq. ft., 304 S/S.
3—Shriver 36" P&F 42 chambers.
2—Shriver 30" P&F 30 chambers.
6—Sperry 24" P&F 16 chambers.
2—Sperry Aluminum 30"x24".

### PULVERIZERS—CRUSHERS

3—Ball & Jewell #2, #1½ Rotary Cutters.
1—Devine 5'x10' steel jacketed Mill.
4—Hardinge Mills 4½'x16", 6'x22', 8'x36", 10'x48".
1—Raymond #40 Imp Mill, 304 S/S.
4—Patterson 6'x8', 5'x6', 3'x4' brick lined Pebble Mills.
1—NEW Patterson 6'x8' porcelain Pebble Mill 50 HP.
2—National 6"x12" Plastic two-roll Mills.
3—Gayco Air Separators 6', 3', 18" dia.
3—Mikro Pulverizers #4TH, #2.

### CENTRIFUGALS

1—AT&M 42" Suspended, 347 S/S.
1—AT&M 40" Suspended, rubber perforated.
1—AT&M 40" Suspended, steel.
1—Bird 40" Suspended, rubber.
3—Tolhurst 40", 32", 26" Suspended, steel.
1—AT&M 36" center slung, rubber.
1—Fletcher 30" Suspended, steel.
1—Tolhurst 26" Suspended, rubber.
2—Baker Perkins #HF-2000 Ter Meer.
2—Bird 18"x28" solid bowl, 310 S/S.
2—Sharples #PN Super-D-Canters, S/S.
2—Sharples #C-27, #C-20, S/S Super-D-Hydrators.
2—Sharples #16-P Monel and S/S Super Centrifuges.

### SCREENS

4—Rotex double and single deck 40"x 120".
2—Rotex double and single deck 40"x 84".
1—Patterson single deck 40"x84", S/S.
3—Robinson single deck 40"x84", S/S.
3—S. W. single deck 40"x84" S/S.
1—Rotex three deck, 20"x81".

### MIXERS

10—Day "Cincinnatus" double arm Sigma Blade, 660, 250, 100 and 50 gals.
2—Baker Perkins 100, 50 gal. Sigma Blades, jacketed.
4—Sprout Waldron S/S, jacketed Powder Mixers 27 and 10 cu. ft.
1—Struthers-Wells 6'x9' S/S, jacketed.
2—Patterson 6' and 5' Steel Conical.
2—Baker Perkins 2 gal. S/S.
1—Robinson 4000# steel Powder.
6—Rodgers 400 to 3000# Powder.
3—Simpson Intensive Mixers #0.
8—NEW Portable Agitators ¼ to 5 HP.
4—Day, Ross 8 and 50 gal., Pony.

### TOWERS—REACTORS—CONDENSERS & TANKS

1—Buflovak 800 gal., 347 S/S jacketed, agitated Reactor.
1—Pfaudler 1030 gal. glass lined, jacketed Reactor. NEW.
4—Buflovak 4000 gal. steel, jacketed, agitated Reactors 50 psi.
1—10,000 gal. Aluminum Storage Tank 10'x16'x½" shell.
5—Towers 7'x25'6", 347 S/S, 6'x63', 6'x58' chrome-lined 42"x49', 3'x53'.
4—Foster Wheeler Karbate Heat Exchangers 188 sq. ft.
3—Heat Exchangers 100, 200 and 300 sq. ft., 304 S/S.
12—Heat Exchangers 50 to 2400 sq. ft. Admiralty and steel.

### MISCELLANEOUS

1—Foster Wheeler Dowtherm Unit with super heater, 4½ million BTU.
8—Nash Vacuum Pumps #H-7, #H-6, #4, #2, #L5, #L3, #MD571.
2—Beach-Russ #50D Vacuum Pumps, 50 cfm.
20—Durimet, Olivite 316 S/S Duriron Centrifugal Pumps 1" to 3".
10—Centrifugal Pumps 60 to 2000 gpm, motor driven.
11—Stokes #DDS2 and "R" Tablet Machines.

**GEORGE G. RODGERS**
*DIVISION*
**NEW EQUIPMENT**
MFGRS. OF
**MIXERS**
SIDE ENTERING
TOP ENTERING
PORTABLE
**POWDER BLENDERS**
**KETTLES**
**REACTORS**
**TANKS**, STAINLESS STEEL
**BALL & PEBBLE MILLS**
**FABRICATIONS**
SEE OUR AD ON PAGE 377

**IF YOU DON'T SEE IT LISTED—ASK FOR IT—WE HAVE IT**

TEXAS OFFICE—4101 SAN JACINTO ST., HOUSTON 4, TEXAS TEL.: JACKSON 6-1351

**BRILL EQUIPMENT COMPANY**
2401 THIRD AVENUE, NEW YORK 51, N. Y.
*Telephone: CYpress 2-5703 • Cable: Bristen, N. Y.*

A SINGLE ITEM OR A COMPLETE PLANT

Write, wire or phone us for complete information — Send us your surplus equipment lists today

# Late Type Rebuilt Equipment

## *For Immediate Delivery — Great Savings*

UNION Rebuilt Machinery Established 1912

**MIXERS**

850 gal. Jacketed Mxing Tanks.
Day 35 to 75 gal. S. J. Imperial Double Arm Mixers.
Day 650 gal. Jumbo S. J. Mixer.
Stokes, Day, New Era, Hottman Mixers, from 2 to 450 gal., with and without Jackets, Single, Double Arm Agitators.
Baker Perkins, Day Readco Heavy Duty, 2 to 160 gals., Double Arm Jacketed Mixers with Sigma or Fish Tail Blades.
Gemco 56 cu. ft. Double Cone Blender.
J. H. Day 50 gal. Imperial S. S. Jacketed Double Arm Mixer.
Day, Robinson, Bailey, 15 to 10,000 lbs., Dry Powder Mixers.

**LABELERS**

Resina LC, Capem, Elgin Cappers.
Burt Wraparound Labeler, to gal.
Pony M, MX, ML, World, Ermold, Pneumatic Semi and Automatic Labelers.

**FILLERS**

Stokes and Smith B Auger Transwrap, Electric Eye.
Horix and Elgin Rotary Fillers.
S. & S. G1, G2, G6, HG88 Fillers.
MRM S. A. Stainless Steel Vacuum Fillers.
Triangle Elec-Tri-Pak Fillers, all sizes.
Elgin 5-Head, Hope 1, Filler 2 and 4-Head Stainless Steel Piston Fillers.

**PACKAGING MACHINES**

ABC Automatic Carton Sealer.
Standard Knapp 429 Carton Sealers.
Miller, Hayssen, Package Machinery, Oliver, Campbell, Transwrap Wrappers.
Pneumatic Scale Packaging Unit with high speed Carton Feeder and Bottom Sealer, 2-Two Scale Weighers, Top Sealer with Compression Drying Unit, Glue Tight Wrapper, interconnecting conveyors.

**GRINDING MILLS - SIFTERS**

Mikro 2TH, 1SH and Bantam Pulverizers: Schutz O'Neill Mills.
Charlotte #3 Monel Colloid Mill.
Eppenbach V9 Aloxite Colloid Mill.
Rotex, Day, Robinson, Tyler Hum-mer, Great Western, Gayco, Raymond Sifters.

**MISCELLANEOUS**

Podbelniak 6080 S. S. Solvent Extractor.
Oliver, Sweetland #2, Sparkler, Sperry, Shriver, Alsop Filters.

**OVER 5,000 MACHINES IN STOCK - INSPECTION INVITED**
***Complete Details and Quotations Available - Write Today!***

**UNION STANDARD EQUIPMENT CO.**
318-322 Lafayette Street New York 12, N. Y.

*Immediate Deliveries*

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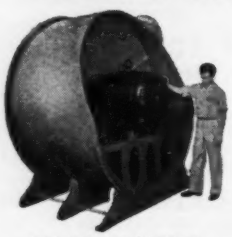
## *NEW and REBUILT*

• FANS • BLOWERS
• EXHAUSTERS



TURBO BLOWERS

**Save 30% to 50% on Stock Shipments**

• We can supply all leading makes of — Rotary Positive Blowers . . . Turbo Blowers . . . Centrifugal Fans . . . Steel Plate Exhausters . . . *fully guaranteed*. Whether you need 1 cu. ft. of air or 100,000 we have the blower to do it. We have had 28 years of exclusive rebuilding experience on this type of equipment.

• Send us your requirements or write for complete listings.

**WM. M. MEYER & SONS, Inc.**
8243 Elmwood Avenue
SKOKIE, ILLINOIS (Chicago Suburb)
Chicago Telephone—KEystone 9-8260

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## December Specials

13,500 gal. Type 347 S.S. Hor. Tank
AT&M Centrifuge SS, 42", w/40 H.P. mtr.
BP 100 gal. SS Mixer, 20 HP Exp. Mtr.
Lee 500 gal. 316 SS Still, complete unit
Ertel 15"x15" SS Filterpress, brand new
500 gal. 36 SS Reactor, Jktd, Agtd. 7½ HP
Oliver Filter 8'x8', Acid Resistant, 15 HP
Mikro Pulverizer #4 with 40 HP motor
Day 5 gallon SS Jktd Mixer, sigma arms
Raymond #40 SS Imp Mill, 40 HP motor
Gen. American 42"x120" twin drum dryer

NEW—Steel & S/S Mixers, Kettles & Tanks, Fabricated To Your Specifications. Engineering Advice Available.

WE BUY COMPLETE PLANTS OR SINGLE UNITS. WHAT HAVE YOU FOR SALE OR TRADE?

*YOU CAN BANK ON*
**EQUIPMENT CLEARING HOUSE, INC.**
111 33rd Street, Brooklyn, N. Y.
*SOuth 8-4451—4452—8782*

---

## STORAGE TANKS

**—Prompt Shipment—**

**GLASS LINED TANKS — USED** — 3000 gallon capacity. Welded construction — Fully insulated. Equipped with manhead. Suitable for milk, food products, lily white chemicals, solvents and fine lacquers.

**VARNISH TANKS—USED**—54" diameter x 14'6" high (or long) ¼" Steel—Welded construction—1700 gallons.

**MISCELLANEOUS TANKS**—Various sizes and types.

**ERMAN-HOWELL DIVISION**
**LURIA STEEL & TRADING CORP.**
332 South Michigan Ave.
Chicago 4, Ill.
*Telephone:* Wabash 2-0250

---

*SAVINGS IN NEW AND USED*
## PROCESS EQUIPMENT

For Laboratory and Production

**HIGH SPEED STONE MILLS**
**PEBBLE MILLS; Large Selection**
COLLOID AND ROLLER MILLS, AGITATORS MIXERS, CRUSHERS, FILTERS, STRAINERS CENTRIFUGES, PUMPS, TANKS, KETTLES HOISTS, EX. PR. LIGHTS AND GENERAL PAINT FACTORY SUPPLIES OF ALL TYPES
**SPOT LOTS OF RAW MATERIALS TO BUY OR SELL— *TRY***
**GENERAL TRADERS, Inc.**
2627 Grand Ave. Chicago 12, Ill.
PH: ARmitage 6-9050

---

## 2-TURBO GENERATOR UNITS

Westinghouse turbine, Max. press. throttle 340# P.S.I.G., Bleeder Station 110# P.S.I.G., Exh. 30# P.S.I.G. Satu. Steam. Ser. Nos.—12750 & 12751.

W.H. AC gens., 1563 K.V.A., 480 volts, 1880 amps., 60 cycle., 3600 R.P.M., type SO-2G135, 80% P.F., 3 ph., Ser. No.—4953392-93.

W.H. DC exc., type SK, 10 K.W., 125 volts 128 amps., 3600 R.P.M., frame 43, sty. No. 2G136.

*Still on fndn. In exc. condition.*
*Price and further inf. on request.*

**PHILADELPHIA TRANSFORMER CO.**
Box 566 Dalton, Pa. *Ph.:* 3-4811

# SEE OUR STOCK

***Plan to visit us when you come to Philadelphia for the CHEM-SHOW Dec. 5 - 9th.***

## AUTOCLAVES

2—Blaw Knox ½ gal. St. St. agit. 2000# Pr.
3—St. St. T347, 13 gal., 1400# test, 50# jkt.
1—45 gal. total cap. T347 St. St. with agit; 550# int., 150# jkt.

## CENTRIFUGALS

1—AT&M Susp. 48" dia. Perf. Basket, St. St., Fume tight
1—Fletcher Susp. 40" dia. Imperf. Basket, Steel
1—Tolhurst Susp. 26" dia. Imperf. Basket, Steel
1—Bird 36" x 50" Solid Bowl, Steel
1—Bird 24" Horiz. Steel
1—Sharples 16P Pressuretite, St. St. UNUSED
6—DeLaval Nos. 74-11; 94-01; 600, LA-11

## CONDENSERS-EXCHANGERS

10—St. St., Shell & Tube—to 800 sq. ft.
4—St. St. Coil type—40 & 55 sq. ft.
8—Steel, Shell & Tube—785, 446, 335 sq. ft.

## DRYERS

1—Bowen 5' dia. Stainless Steel Spray Dyer
1—Stokes 3' dia. x 15' long Jacketed Rotary Vacuum Dryer
4—Double Drum Dryers: 42" x 120"; 24" x 60"; 22" x 38"
4—Rotary Hot Air Dryers or Kilns: 10'6" dia. x 105' L, 5' x 30', 4'6" x 40', 3' x24'
3—Rotary Furnace Tubes 24" D x 8'6" L —Chrome nickle Alloy
1—Hardinge XC-2 Ruggles Coles Rotary Steam Tube Dryer, 4' D x 30' L

## EVAPORATORS—STILLS

1—Goslin-Birmingham 6775 sq. ft. Quadruple Effect, Vertical long copper tubes.
1—Conkey 1900 sq. ft. Triple Effect, Vertical long Herculoy tubes
1—Buflovak 588 sq. ft. Double Effect, all stainless steel
2—5' dia. Nickle Clad Evaporators with nickle tube bundles
1—Stainless Steel, 145 sq. ft. coil, 500 gal.
1—Stokes 150 gal. St. St. Jacketed Vacuum Still
2—Aluminum Bubble Cap Columns 36" dia. x 45 plate
3—Stainless Steel Packed Columns: 8" dia. x 26' H; 14" dia. x 25'; 23" x 80"
2—Stainless Steel Cascade Columns 5' dia. x 50' high

## KETTLES

4—St. St. closed—to 1300 gal.
35—St. St. open top—to 550 gal.
5—Aluminum, closed, 35 to 250 gal.
7—Copper, open top, 80 & 100 gal.
2—Horiz. Steel, Vacuum or Pressure Cookers, Agitated, 5000 gal. & 8500 gal.

## FILTERS

3—Sweetland Fiters: #12 (72 lvs.); #5 (20 lvs.); #2 (18 lvs.)
2—Oliver 5'3" dia. x 8' F Continuous Panel Type Filters, gas tight hoods and repulpers—UNUSED
1—Swenson 8' x 8' Rotary Vacuum Filter, Precoat type. Acid proof construction
5—Cast Iron Filter Presses, 30" x 30" open delivery, 28, 35, and 50 chambers
4—Filter Presses, closed delivery, 12" to 36"
1—Niagara #110-20 St. St. Pressure Filter, 110 sq. ft.

## MILLS

1—Patt. Fdy "DJ" Unlined Jacketed Steel Ball Mill, 6' dia. x 8' long—UNUSED
2—Pebble Mills 6' D x 8' L
1—Al. Ch. 6' D x 16' L Steel Lined Contin. Ball Mill
3—4'6" D x 12' L contin. Pebble Mills
1—Hardinge 6' D x 22" L Conical Ball Mill, Steel Liner
1—Charlotte #50 Colloid Mill, 75 HP
1—Penna Ring Type Granulator, Trojan K3-24, 40 HP
1—Fitz. Mill F-8 St. St.
4—Hammer Mills: Gruendler 36 x 24; Jay Bee 75 HP; Williams 14" x 14"; Williams size A, St. St. and Aluminum
1—Sturtevant 8 x 10 Jaw Crusher
3—Attrition Mills, 30", 24" & 16"
1—Pug Mill, St. St., two 7" dia. overlapping chambers 3'9" L. Jktd.

## MIXERS—BLENDERS

4—Ribbon Mixers, 336 cu. ft. work. cap.
2—W & P Sigma Blade Double Arm Jacketed Mixers, 100 gal. work. cap.
3—Patt. Kelly St. St. Twin Shell Blenders, 5 & 10 cu. ft. work. cap.
9—Side Entering Stainless Steel Mixers, 7½ HP. 10 HP, 15 HP & 25 HP

### *JUST PURCHASED*

4—Readco Heavy Duty Double Arm Sigma Blade Jacketed Mixers 50 gal. work. cap. 30 HP Expl. Pr. Motor. Built 1951-53
3—Bartlett-Snow 6' dia. x 3' deep Jacketed Stainless Steel Mixing Kettles

## TANKS

12—Aluminum, 3000 gal., 5 compart.
10—Aluminum, 500 gal., 80# WP.
1—Monel, 450 gal., coils
1—St. St., T304, ⅛" 10,500 gal. Horiz.—UNUSED
1—St. Clad, T304, ⅜", 6500 gal. Vert.
1—St. St. T316, 5/16", 4000 gal. Hor.
1—St. Clad T304, ⅜", 2000 gal., Vert., Jktd. VACUUM
10—St. St. Pressure Tanks—to 4000 gal.
20—St. St. Storage Tanks—to 1000 gal.

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5—Baird, Ruggles Coles and Louisville 4' x 30' to 6' x 35' rotary & tubular dryers
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2—Patterson 3' x 4' porcelain lined pebble mills
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1—National Erie 8½" strainer
1—Buflovak 24" x 36" double drum atmospheric dryer
1—Buflovak 24" x 48" double drum vacuum dryer
4—2½-15-40 gallon Pony mixers
1—Buflovak 24" x 36" double drum dryer
1—Buflovak 24" x 48" double drum atmospheric dryer
4—8-15-40 gallon Pony mixers
6—Rotex sifters 20" x 48" up to 40" x 84"
8—Double arm jacketed and unjacketed mixers, 2½ gallons to 150 gallons
4—700 gallon steel mixing tanks, 2 HP, x proof
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2—300 gallon S/S jacketed and agitated processing kettle*

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SEPARATOR—Gayco 30", 36" & 14' dia.
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SS 18-8 Scrubber, 12"x15'.
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6'x29' 21 trays, Stainless.
5'x24' 24 trays, Everdur.
7'x54' 20 trays, 150 PSI.
6'6"x40' 16 trays, 80 PSI.
3'x44' 18 trays, 300 PSI.
Karbate #22, packed, 19"x12' NEW.
4'x59' 23 trays, 160 PSI.
7'6"x41'7" Reactor, 160 PSI.
4'6"x40' 13 trays, 180 PSI.
2'x47' 20 trays, 200 PSI.
2'x47' 20 trays, 375 PSI.
3'x49' 28 trays, 425 PSI.
2'x37' 16 trays, 250 PSI.
5'x36' Scrubber, 240 PSI.

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100 gal. Readco, jktd. dbl. sigma blades.
170 gal. Ajax dbl. arm, power dump.
1050 gal. Paddle dbl. shaft heavy duty.
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Roto-Louvre 705-20 SS heating coils comp.
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Rotary 4'x27' oil fired, motor drive.
Rotary 5'x67' 6" lifters.
Rotary SS, 4'x30' complete.
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10'x48" Hardinge Ball Mill.
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Steel Tubes, 94 to 550 sq. ft. (5).
Adm. Tubes, 140 to 440 sq. ft. (7).
100 sq. ft. SS 40# shell 60# tubes.
198 sq. ft. steel 325# Adm. tubes 125#.
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NEW Steel and Stainless Steel Ribbon Mixers from 400 lb. to 10,000 lb.
Porter Type 316 Stainless Mixer; 30"x36"x57"; center discharge.
Lancaster Mix Mullers, complete with accessories; several sizes.
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W&P Type Double Arm Heavy Duty Jacketed Mixer; 100 gal. & 200 gal.

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Baker Perkins Termeer Centrifuge in Type 316 SS; Model S12; 7½ HP motor.
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Double drum atmospheric to 120".
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Evaporators: Swenson triple effect 350 sq. ft., single effect 350 sq. ft.
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Rogers Special 6' stain. steel.
Exchanger, heat: Walker Wallace st. steel, plate type, 200 GPH.
Feeders: Syntron F-22, 10 x 36" trough.
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Filter Presses: Sperry, Shriver 6" to 36", recessed and plate and frame types.
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Devine 1500 gal. jacketed, agitated.
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Raymond laboratory Screen Mill.
3-roll: Day 12 x 32", Ross 12 x 30".
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Dry Powder: 1½ to 77 cu. ft.
Dry Powder: Robinson copper body, 60 cu. ft. and 27 cu. ft.
Liquid, tank to 500 gal.
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2—8'x125' Rotary Kilns.
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1—#2 Simpson Mixer, motor drive.
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1—#502-16 Link Belt S/S Roto-Louvre Dryer.
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3—6'6"x50' D. H. Rot. Dryers.
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1—50 gal. Stainless 347, Calandria Still, Agitated, with Condenser.
1—50 gal. Stainless 347, Agitated Tank, Motor Driven.
9—Sperry 18"x18 Iron recessed Filter Presses, 18 chambers.
3—450 gal. S.S. Steam Jktd. Kettles.
1—Buflovak 48"x40" Drum Flaker, chrome plated, S/S ends.
1—Oliver Rotary Acid Filter, 6'x6'.
4—Mojonnier, S.S. Vac. Pans, 3', 5', 6'.
3—6'x50' L'ville Rot. Tube Dryers.
1—Day size 30 Imperial Jacketed 75 gal., Sigma Blades.
1—2TH, Mikro Pulverizer.
4—Buflovak Atmo. Dbl. Drum Dryers 24"x36", 32"x90", 42"x120".
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100 S/S KETTLES from 2¼ to 125 Gal
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Feinc 6' dia. Horiz. Filter S/S and Steel construction.

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All units in very good condition.

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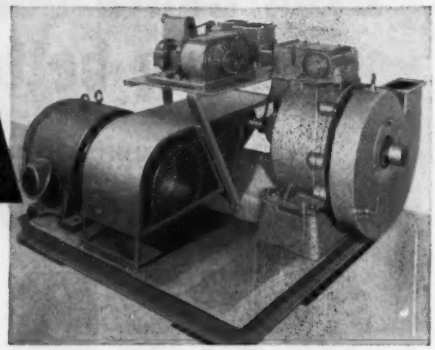

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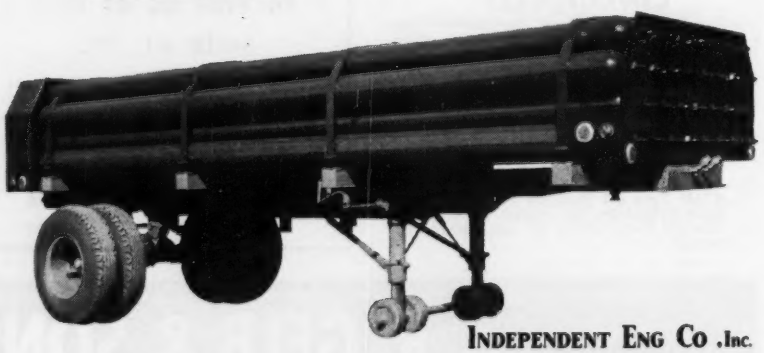

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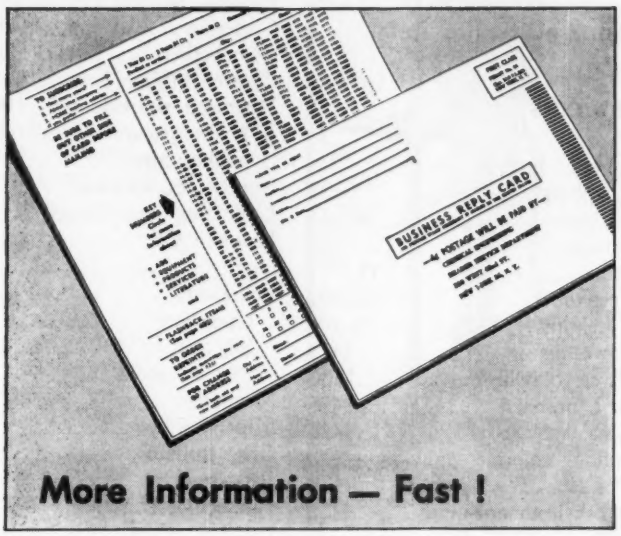


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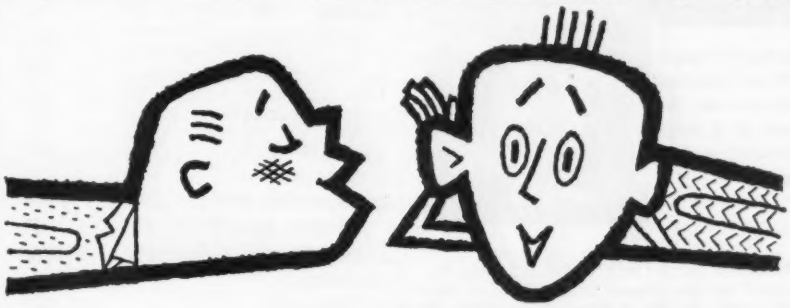

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## Inside—Outside Topside!

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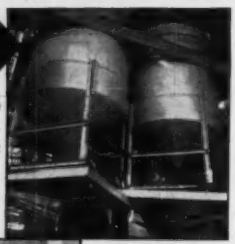
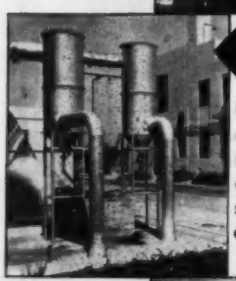
**Inside**



How Multi-Wash collectors can be installed, up off the floor, inside the building.



**Outside**

Installation of collectors outside the plant, conserving floor space for productive work.

**Topside**

Battery of Multi-Wash units installed on the roof of a large production factory.

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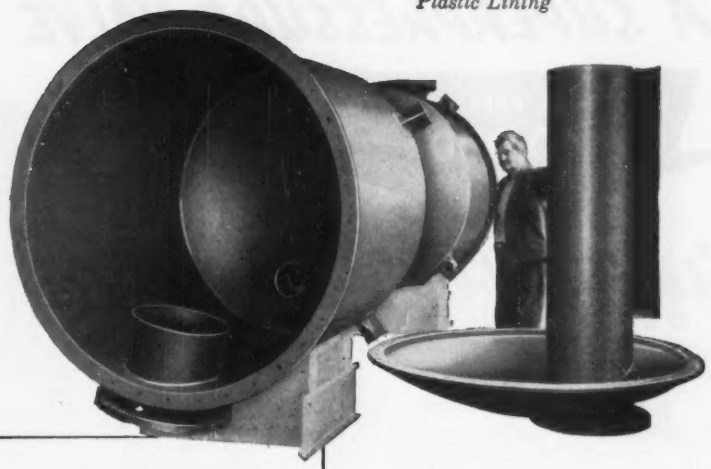

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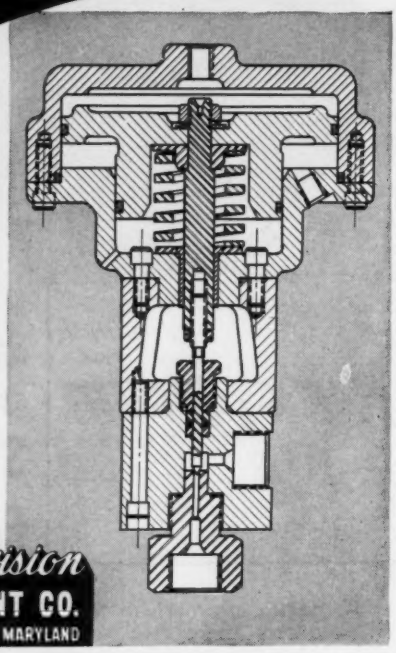

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**AMERICAN INSTRUMENT CO.**
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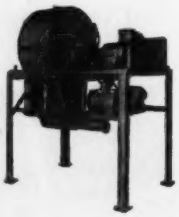

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**87 Gardner Street, West Roxbury 32, Massachusetts**

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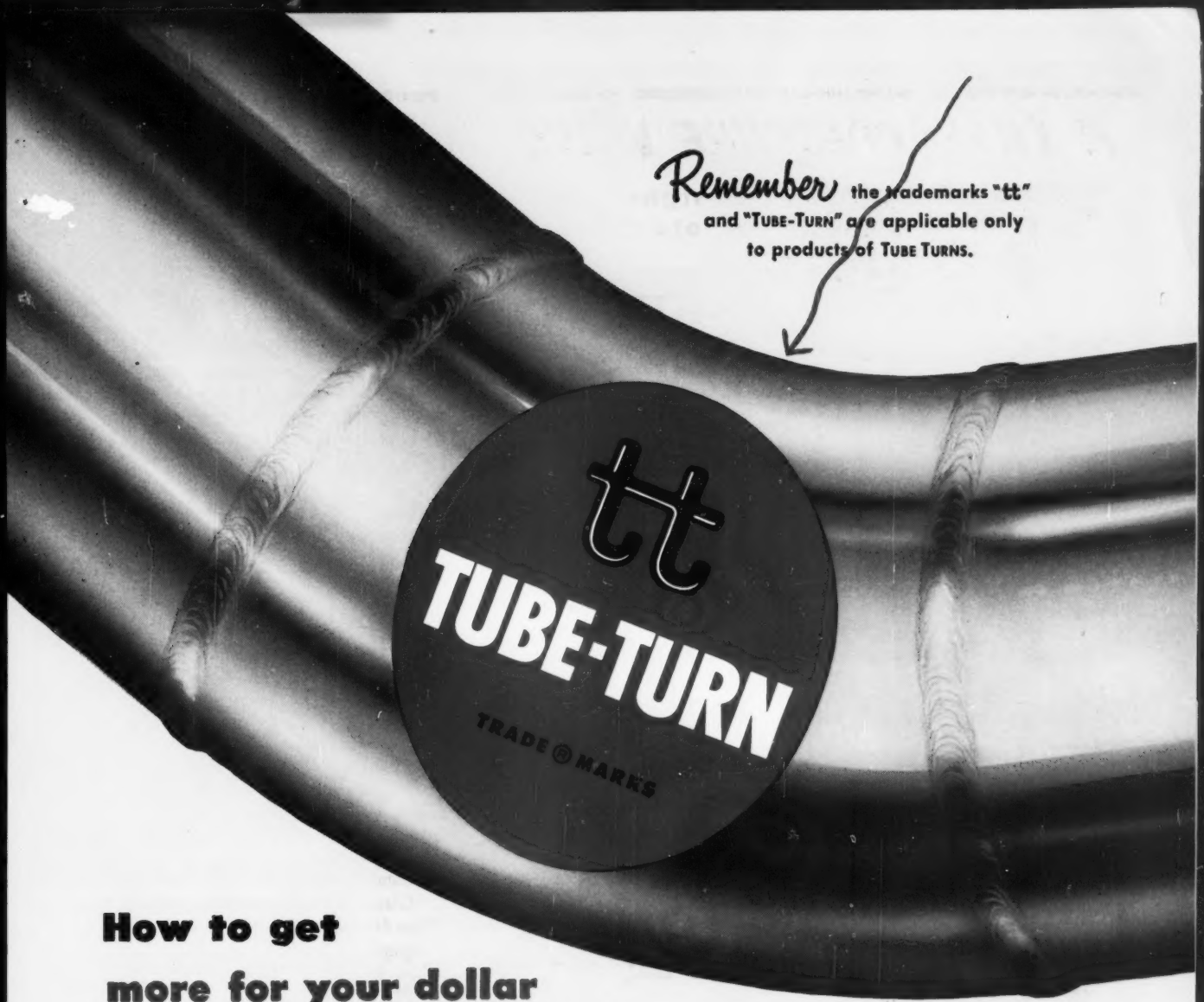


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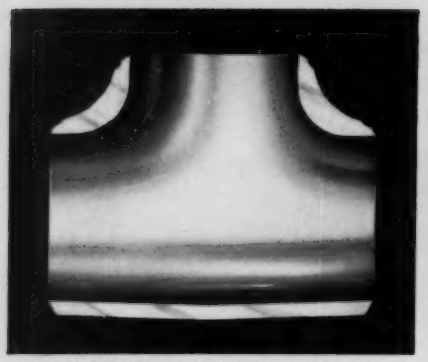

**MATCH PIPE** for calculated bursting strength.

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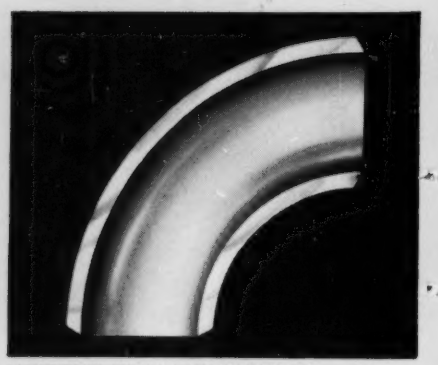

**UNIFORM WALL THICKNESS.** Pipe minimum wall thickness tolerance of 87½% of nominal thickness is maintained.

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## Stainless Steel Welding Fittings and Flanges offer you these extra values

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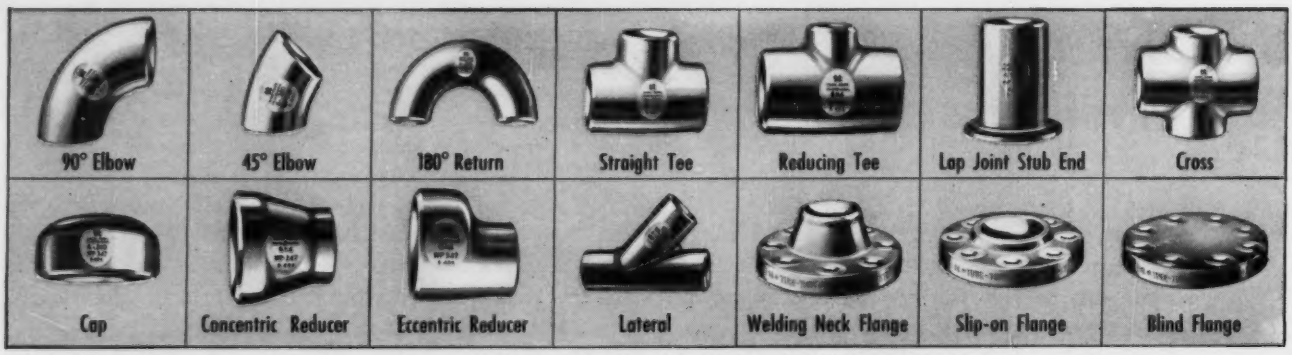


**COMPLETE LINE IN STOCK . . .** four analyses: Type 304, 304L, 347 and 316. Four wall thicknesses: Schedules 5S, 10S, 40S, 80S.

**WALL CHART** of dimensions of popular sizes of TUBE-TURN Stainless Steel Welding Fittings and Flanges.

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Processing, ultrasonic .....256D
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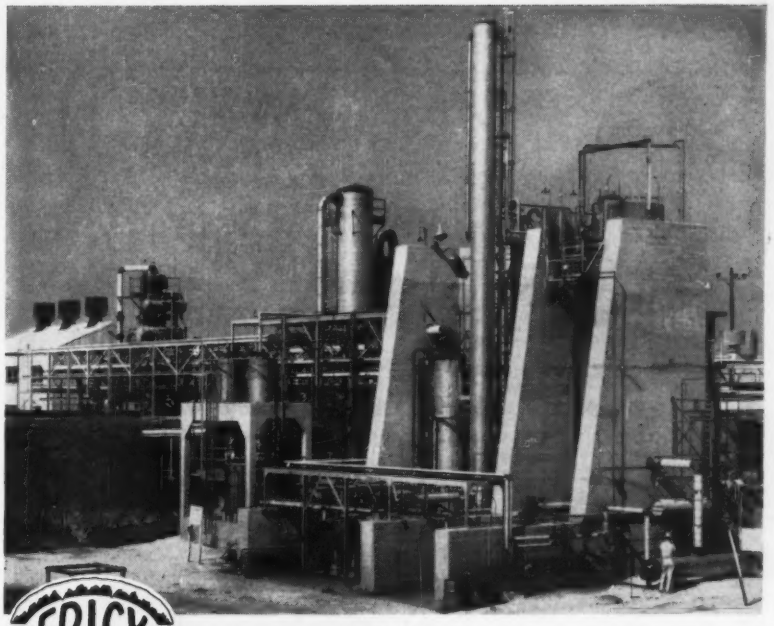
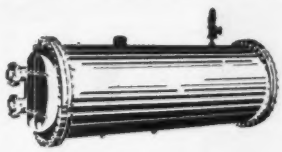


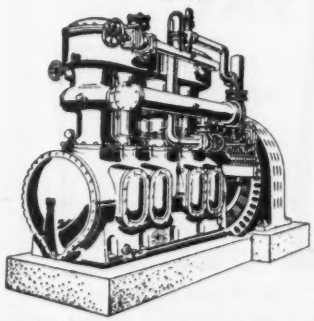
FRICK

# Heat-Exchange Equipment Selected for Olin-Mathieson Rocket Fuel Plant

**When Olin-Mathieson specified Frick oil separators, accumulators, interstage flash coolers and condensers for their hydrazine plant at Lake Charles, La., many factors influenced the decision . . . . ability to manufacture to rigid specifications . . . price considerations . . . experience with similar orders . . etc. But the deciding factor in this purchase was the engineering service which Frick Company offers to its customers.**



Frick Company specializes in the manufacture of all types of pressure vessel and heat exchange equipment.



Frick compressors are manufactured in 83 types and sizes to fit every cooling requirement.

**Drawing upon the accumulated experience of over 70 years of service to industry, Frick Company's engineering staff is particularly well equipped to come up with the right answers to your heat transfer, refrigeration and air conditioning problems.**

**Tell us what you want to cool, and we will design the system to suit your needs exactly. For purchasers who wish to specify complete installations with unification of responsibility, we offer the services of our Erection Department.**

**Write, wire or phone for complete details.**

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WAYNESBORO, PENNA. U.S.A.

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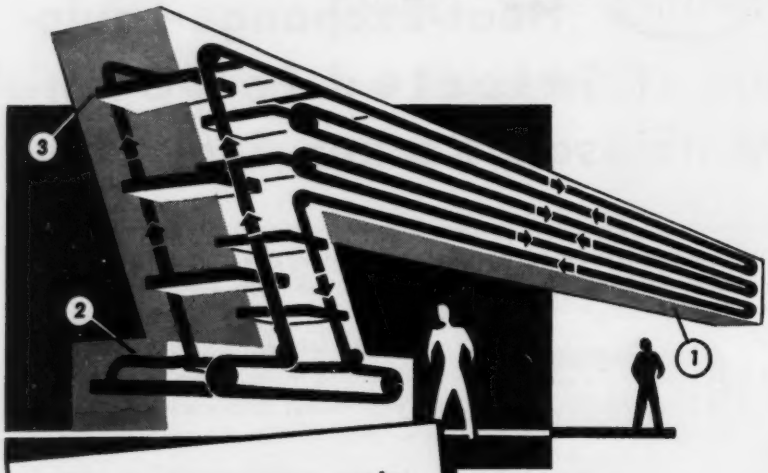
Make new **PROFITS** from unused overhead space while processing your products under exact time, temperature, and atmospheric **CONTROL**

**... with a GREER MULTI-TIER**

Converts heating, cooling, drying and similar operations from batch to continuous processing. In one application alone, MULTI-TIERS have increased production 5 times per man, in 1/10th the floor space.




① Saves floor space—ample headroom.

② Multi-Tier trays convey products through controlled processing cycles of 10 minutes to 10 hours without jar or jolt. Automatic or manual loading and unloading.

③ Trays always perfectly level —custom fitted to your product.

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Wilmington, Massachusetts

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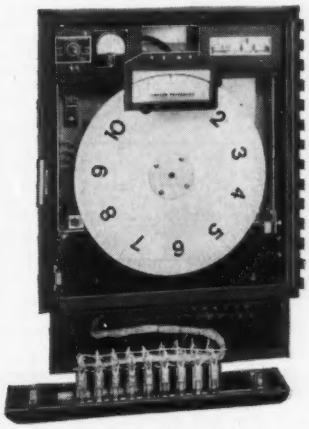
ANOTHER NEW T-E INSTRUMENT—
A SELF-BALANCING INDICATOR WITH BUILT-IN KEY-TYPE OR PUSH-BUTTON SWITCHES.

**FUNCTION**

To check rapidly and accurately the temperatures at numerous points in any process.



Interior view of indicator with hinged cover removed and key switch panel opened to show details of construction.

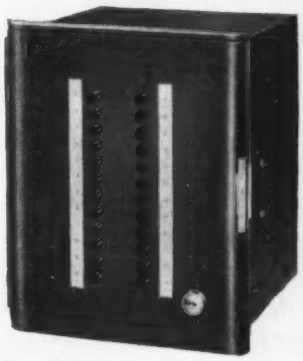
**DESIGN**

This instrument incorporates a simple electronic continuous balancing system with only two moving parts. Twenty-three scale ranges are provided: from −320° to +200°F. up to 0° to 3000°F. Accuracy is ±¼ of 1% of scale range . . . sensitivity is 1/20 of 1% of the range. Automatic cold-junction compensation is provided.

The maximum capacity of the indicator with built-in key switches is 48 points for thermocouple use and 36 points for resistance bulbs. With push-button switches the maximum is 24 points for either thermocouples or resistance bulbs.

**OPERATION**

Read scale at hairline in window . . . the next reading will be ready before you can log the last measurement. Balancing speed for full scale deflection is four seconds.



***Write Today For Catalog 61-E For Complete Details.***

New T-E Push-Button Selector Switch Unit with capacities up to 36 thermocouples or resistance bulbs. A larger case with capacities up to 72 sensing elements is available.

Features self-locking push-buttons that release automatically when any other button is pushed. Also possible to obtain average temperature readings over several points by depressing the buttons simultaneously.

**Pyrometers • Temperature Monitoring Systems • Thermocouples • Protection Tubes**
**Quick-Coupling Connectors and Panels • Thermocouple and Extension Wires**

**Thermo Electric Co., Inc.**
**SADDLE RIVER TOWNSHIP, ROCHELLE PARK POST OFFICE, NEW JERSEY**
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# Guide to Technical Literature

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### What It Contains . . .

This is a comprehensive listing of the latest literature you can now get from manufacturers on chemicals, equipment and services in all fields of interest to chemical engineers. It lists new publications just released, in addition to technical literature mentioned in the advertisements in this issue. The latter are identified by an asterisk (*) alongside the company name.

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**Acid, Fumaric**.....Offers shorter drying time for alkyd resins, increased viscosity for rosin adducts. In purified form, it's an ideal acidulant for foods and pharmaceuticals. Technical Bulletin No. 46.
**164** *Chas. Pfizer & Co.

**Acid, Muriatic**.....Features high purity muriatic acid—Hooker White. This special grade muriatic is entirely free of arsenic. Contains .003% or less sulfates, & .0001% or less iron. Technical Data Sheet.
**160c** *Hooker Electrochem Co.

**Acrylic Esters**.....Covers ethyl acrylate, n-butyl acrylate 2-ethylbutyl acrylate & 2-ehtlhexyl acrylate. Includes methods of polymerization, applications of polymers & copolymers, etc. Bulletin No. F-7434.
**442A** Carbide & Carbon Chem.

**Alcohol, Primary**.....20 p. refernce describes Hercules Abitol, a primary alcohol—viscous . . . resinous . . . high molecular weight. Includes physical & chemical properties, applications, use in alkyd resins.
**442B** Hercules Powder Co.

**Alumina, Activated**.....Alcoa Activated Aluminas are among the most effective and efficient desiccants available for the dehydration of liquids and gasses. Furnishes complete information and product samples.
**51** *Aluminum Co. of America.

**Alumina, Activated**.....New Product Data Sheet furnishes a detailed technical description of Reynolds Activated Alumina. Includes advantages, applications, chemical specifications, etc. Request Form No. C4-5-755.
**442C** Reynolds Metals Co.

**Aluminum Chloride**.....Surface area of a solid catalyst, such as aluminum chloride, bears an important relationship to reaction rate. That's why company produces it in 4 different mesh sizes. Full data.
**160a** *Hooker Electrochem. Co.

**Amines**.....52 p. booklet contains complete descriptions of Sharples Aliphatic amines for the process industries: chemical reactions; physical properties; applications; toxicology; storage and handling; etc.
**442D** Sharples Chem.

**Aminoethyl Ethanolamine**.....A hygroscopic liquid with a medium viscosity and a mild, ammoniacal odor. Describes applications, physical properties, specifications, handling precautions, etc., in Booklet No. F-6455A.
**442E** Carbide & Carbon Chem.

**Ammonium Thiocyanate**.....Valuable Ammonium Thiocyanate Product Bulletin gives information on properties and uses of ammonium thiocyanate, properties of aqueous solutions of ammonium thiocyanate, etc.
**245** *J. T. Baker Chem. Co.

**Antioxidants**.....Antioxidant 425 offers greater protection against discoloration of rubber stocks. Technical Bulletin No. 840 contains complete and up-to-date information on the properties and behavior. 28 p.
**442F** American Cyanamid Co.

**Antioxidants**.....New 24 p. Technical Bulletin describes in detail results of experiments & tests with antioxidant additive for gasolines—2, 6-di-tertiary-butyl-para-cresol (DBPC). Bulletin C-5-179.
**442G** Koppers Co.

**Bleaching, Pulp**.....Groundwood bleaching is used as example of a complex process in which many variables affect final results. Statistical methods applicable to this described in detail. Bulletin No. 31.
**442H** Buffalo Electro-Chem. Co.

**Bleaching, Textile**.....Detailed literature offers a description of dye house practice using hydrogen peroxide for dye oxidation on the jig, packaged and continuous machines. Request Bulletin No. 38 now available.
**442I** Buffalo Electro-Chem. Co.

**Boron Carbide**.....Handbook on boron carbide, elemental boron & other stable, boron-rich materials. Available data, both fundamental & commercial, compiled in book as an aid to those concerned with nuclear problems.
**442J** Norton Co.

**Butyl Oleate**.....Witco butyl oleate is a stable, non-volatile, oily liquid, which will not solidify under normal winter conditions. Description & information on properties contained in Technical Service Bulletin E-8.
**442K** Witco Chem. Co.

**Calcium Glucoheptonate CP & Purified**.....Soluble in water in all proportions. Used for calcium therapy by injection and for milk fever. May be used alone or to solubilize calcium gluconate. Leaflet available.
**442L** Pfanstiehl Labs.

**Calcium Hydride**.....Supplies important data on physical properties, chemical properties and applications, handling and storage, available forms and references on company line of calcium hydride. Bulletin 201-D.
**442M** Metal Hydrides.

**Calcium Silicates, Synthetic**.....New Micro-Cel line can produce many desirable effects: absorption of liquids; uniform dry dispersion; viscosity control; anti-caking agent; etc. Data & product samples.
**150–1** *Johns-Manville.

**Carbon Dosage**.....If you are now using activated carbon in a single-step treatment, split feeding may save you a worthwhile percentage of your carbon cost. New booklet outlines basic principles of this method.
**91** *Darco Dept.

**Catalysts, Molybdenum**.....New reference, "Molybdenum Catalysts for Industrial Processes," includes information on: increased molybdenum catalyst utilization; reactions using molybdenum catalysts; etc. 24 p.
**442N** Climax Molybdenum Co.

**Chemicals**.....44 p. Catalog covers essential properties & uses on chemicals & allied chemical specialties. Includes industrial chemicals, Globrite cleaners, phosphating agents & strippers, fluxes, and many others.
**442O** Globe Chem. Co.

**Chemicals**.....A new Catalogue listing prices and properties of more than 400 chemicals especially developed for use in industrial and research laboratories in the field of polymerization is now available.
**442P** Borden Co.

**Chemicals**.....Liberally illustrated, 28 p. reference graphically depicts in word and picture Diamond Alkali's family of chemical products for industry and agriculture. Request "The Story of the Chemicals You Live By."
**443A** Diamond Alkali Co.

**Chemicals**.....Company announces the availability upon request of their Fall Sales Bulletin, which lists 24 different product lines for research and development by industry, agriculture, and medicine.
**443B** Lachat Biochemical Co.

**Chemicals**.....Valuable reference lists the properties and uses of some 350 of the more than 600 basic industrial, pharmaceutical, and agricultural chemicals currently produced by the Dow Chemical Company. 36 p.
**443C** Dow Chem. Co.

**Chemicals, Agricultural**.....8 p. multigraphed bulletin is a selected collection of the more important, representative terms generally associated with Diamond agricultural chemicals and their applications.
**443D** Diamond Alkali Co.

**Chemicals, Fatty**.....44 p. Catalog contains all standard ADM Fatty Chemicals: hydrogenated glycerides; hydrogenated fatty acids; saturated & unsaturated fatty alcohols; sperm oils; & sperm oil products.
**443E** Archer-Daniels-Midland Co.

**Chemicals, Fatty**.....Issues brochure containing revised, up-to-date specifications of entire product line. Included are: stearic acids, oleic acids, hydrogenated fatty acids & glycerides, plasticizers, etc.
**443F** Emery Industries.

**Chemicals, Furfural**.....Product reference contains general information about company's line of QO chemicals. Covers data on furfural, furfuryl alcohol, tetrahydrofurfuryl alcohol, etc. Bulletin 201-A.
**86-7b** *Quaker Oats Co.

**Chemicals, Industrial**.....24 p. booklet alphabetically lists the numerous chemicals available. Tells the story about Harshaw's growth since its beginning in 1897. Includes pictures of plants, warehouses, etc.
**291** *Harshaw Chem. Co.

**Chemicals, Molybdenum**.....Comprising 7 different papers, newly published survey details molybdenum's wide use in diverse chemical fields, and points to new industrial applications. 32 p. Reference No. Ch-15.
**443G** Climax Molybdenum Co.

**Chemicals, Molybdenum**.....Molybdenum compounds are widely used in production of catalysts, phosphomolybdic-phosphotungstic lake colors, molybdate chrome orange pigments, etc. Technical data, samples, prices.
**443H** J. T. Baker Chem. Co.

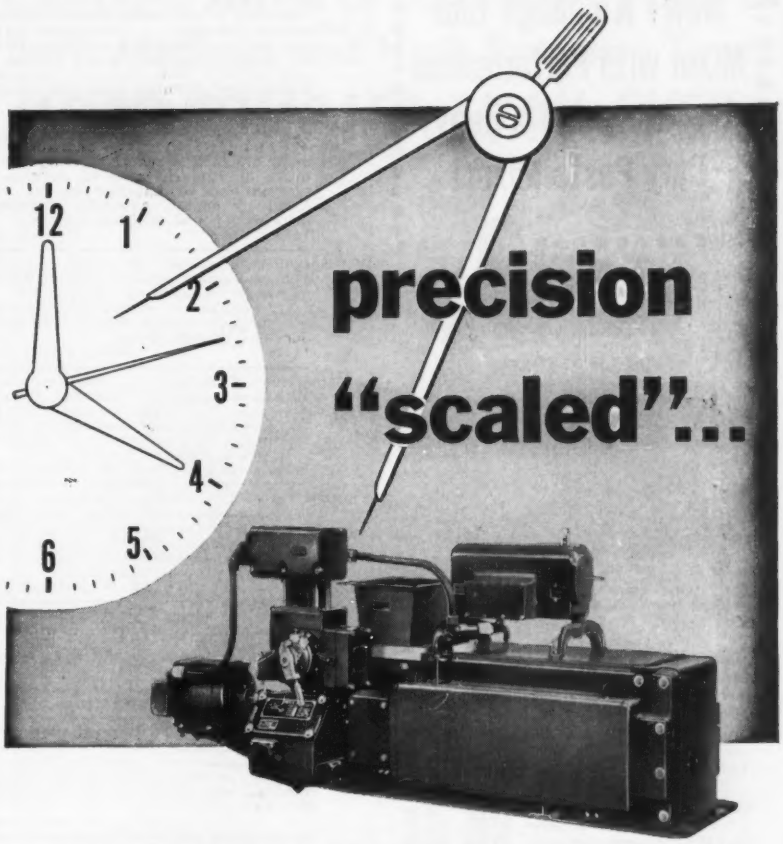
**Chemicals, Organic**.....78 p. plastic spiral-bound brochure deals with insecticides, herbicides & industrial organic chemicals. Each product described, chemical & physical properties listed & applications given.
**443I** Diamond Alkali Co.

**Chemicals for Resin Emulsions**.....Includes data on: monomers; emulsion polymerization; emulsifiers; protective colloids; proportion of emulsifiers & protective colloids; physical modifiers; etc. Booklet No. F-8869.
**443J** Carbide & Carbon Chem.

**Chromates**.....9 p. multigraphed bulletin covers use of chromates for corrosion control in water-cooled or water-circulating equipment, such as refrigeration units, air conditioners, boilers, diesel engines, etc.
**443K** Diamond Alkali Co.

**Cyanuric Chloride**.....Illustrated, 48 p. describes Aero cyanuric chloride: specifications; handling & shipping; toxicity; structure; physical & chemical properties; applications; methods of analysis; bibliography.
**443L** American Cyanamid Co.

*From advertisement, this issue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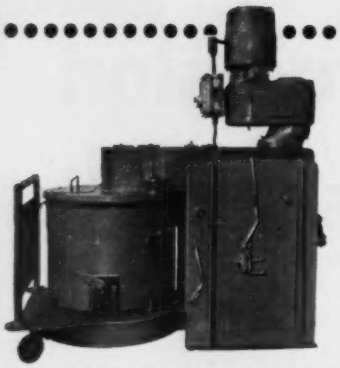

**The "Pony" Paste Mixer comes in 2 convenient types: TYPE 1**—With portable turntable *(shown)*. **TYPE 2**—With attached turntable.

*Unique mixing action!* There you have the "secret" of the "Pony" Paste Mixer. This machine combines the mixing advantages of the sigma blade, or heavy duty, paste mixer with the versatility and ease of cleaning of a change can mixer. Here is how it works:

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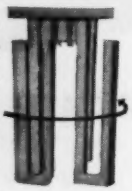

Close-up of the "Pony" Paste Mixer's U-shaped polished steel blades.

The staggered position of the blades permits these intense actions to be in rapid series. This reduces the load on the machine and permits the handling of heavy pastes with comparatively little power requirements.

The wide tapered bottom blades impart an upward thrust and rolling action to the material. The can rotates in the same direction as the mixing blades at an unsynchronized rate of speed. The entire batch is constantly agitated, constantly moving; "dead" spots and stratification of materials are eliminated. This, plus the intense shear developed, guarantees superior wetting, a homogeneous batch and reduces the load in any subsequent dispersing process.

Find out how the "Pony" Mixer can help *your* production. For a free, illustrated folder, fill in and mail the coupon *today!*

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## LITERATURE . . .

**Defoamers, Silicone**.....Defoamers have proved their efficiency and versatility in countless applications. Offers a new booklet with complete informationon Dow Corning Antifoam agents plus a product sample.
**R463** *Dow-Corning Corp.

**Dibutyl Fumarate**.....You can profit by using chemically reactive dibutyl fumurate or fumaric acid to develop a new product or improve an old one. Company makes available complete information and product samples.
**444A** Borden Co.

**Dispersions, Calcium Stearate**.....Describes a new chemical product which improves processing properties & characteristics of coating formulations for machine coated papers. Technical Service Bulletin M-15.
**444B** Witco Chem. Co.

**Dispersions, Colloidal**.....Numerous applications of "dag" colloidal dispersions and their value to marketers of petroleum products and other fluid lubricants are presented in a new illustrated Bulletin, No. 424.
**444C** Acheson Colloids Co.

**Dispersions, Fluorocarbon Polymer**..... 20 p. covers application techniques for Kel-F fluorocarbon polymer dispersions on metallic and non-metallic surfaces—spraying, spread coating, dip and flow coating, baking.
**62** *M. W. Kellogg Co.

**Dispersions, Pigment**.....Company announces the release of a new Technical Bulletin describing and displaying their new line of Accosperse pigment dispersions for latex paint. Properties are covered in full detail.
**444D** American Cyanamid Co.

**Ethylene Glycol**.....Technical literature covers ethylene glycol—a low-volatile, hygroscopic liquid. Includes physical properties, solubilities, specifications, shipping data, etc. Request reference No. F-8327.
**143** *Carbide & Carbon Chem.

**Ethylene Glycol Diacetate**.....An ester solvent with a challenging potential —slow evaporating rate, high boiling point, high flash point, colorless, pleasant odor, etc. Information, samples, technical data, etc.
**37** *Celanese Corp. of America.

**Ethylene Oxide**.....Prepare non-ionic detergents by using high purity Nitrogen Division ethylene oxide. Data & a bibliography of pertinent literature in "The Manufacture of Non-Ionic Detergents from Ethylene Oxide."
**444E** Nitrogen Div., AC&D

**Furfural**.....Rely on furfural for performance . . . uniform purity . . . low cost . . . unfailing availability. Offers technical literature covering its unusual properties and numerous uses. Request Bulletin No. 204.
**86-7a** *Quaker Oats Co.

**Glycol-Ethers** ..... Feature numerous uses: solvents in surface coatings; solvents in dyestuffs, wood stains, and inks; mutual solvents in soaps, oils, and insecticides; diluents in brake fluids; etc. Book No. F-4765.
**444F** Carbide & Carbon Chem.

**Greases, Lithium Base**.....Describes in detail Molykote, Type BR2, a general purpose grease with extreme bearing pressure properties. Include 10 outstanding qualities, physical specifications, etc. Bulletin No. 101.
**444G** Alpha Molykote Corp.

**Hydrogen Peroxide**..... Supplies valuable article reprint, "History of the Hydrogen Peroxide Industry" . . . a review of the manufacture and use of hydrogen peroxide. Request your copy of Bulletin No. 50.
**444H** Buffalo Electro-Chem. Co.

**Hydrogen Peroxide**.....Article reprint includes a detailed discussion of pumps, containers, piping and valves, etc. . . . for handling high strength hydrogen peroxide. Request copy of Bulletin No. 40.
**444I** Buffalo Electro-Chem. Co.

**12-Hydroxystearin**.....Presents technical data on Castorwax 12-hydroxystearin. Gives valuable explanation on where and why low-cost Castorwax is used. Includes formulation information. Technical Bulletin No. 7.
**444J** Baker Castor Oil Co.

**Levulose CP**.....Levulose (fructose) is the sweetest of the sugars. It is used in intravenous feeding because of rapid absorption and lack of insulin demand. Announces availability on request of a Bibliography.
**444K** Pfanstiehl Labs.

**Lignin**.....Gives comparative properties of semi-hard rubber compounds made with Polypol S-70 (coprecipitate of lignin & a butadiene-styrene copolymer) versus the 1500 type GR-S copolymer. Technical Bulletin 203.
**444L** West Va. Pulp & Paper Co.

**Lubricants, Open Gear**.....Covers Molykote 165X . . . an open gear lubricant for application on highly loaded gears which normally can only be lubricated infrequently. Request illustrated Bulletin No. 105.
**444M** Alpha Molykote Corp.

**Lubricants, Silicone Mold**.....Releases a comprehensive study of silicone mold lubricants for the rubber industry. Properties & performance of leading release agents discussed, application methods described, etc. 8 p.
**444N** Dow Corning Corp.

**Magnesias**.....Company makes available their latest magnesia bulletin entitled, "Chemical Magnesias and Magnesite —Technical and U.S.P. Grades." Includes data on specifications, uses and applications. 8 p.
**444O** Harwick Standard Chem. Co.

**Paraffins, Chlorinated** ..... Multigraphed Data Sheet available describing Chlorowax 50—a new, high viscosity, liquid chlorinated paraffin having applications in formulating plastics and protective coatings.
**444P** Diamond Alkali Co.

**Pentaerythritol** ..... "Pentaerythritol in Synthetic Vehicles" provides answers to many of the problems confronting the vehicle manufacturer with regard to the use of pentaerythritol in resins and alkyds. 32 p.
**444Q** Delaware Chem.

**1, 5-Pentanediol** ..... Makes available technical information on 1, 5-pentanediol (pentamethylene glycol). Includes physical properties, net container contents, reactions & applications, etc. Reference No. F-40006.
**444R** Carbide & Carbon Chem.

**Plasticizers**.....Citroflex plasticizers are unique in that they are all derived from citric acid, a tribasic, monohydroxy acid well known for its many food applications. Details of line in Technical Bulletin No. 31.
**444S** Chas. Pfizer & Co.

**Plasticizers**.....76 p. includes selector chart based on compatibility, physical properties & descriptions of Flexol plasticizers, & discussion of relation of physical properties to performance characteristics.
**444T** Carbide & Carbon Chem.

**Polyethylene**.....Fully illustrated, 20 p. describes Super Dylan polyethylene: heat resistance; rigidity; chemical resistance; low temperature toughness; tensile strength; applications; etc. Reference No. C-5-216.
**444U** Koppers Co.

**Polyethylene**.....New brochure, "A-C Polyethylene for Rubber Compounding," lists the advantages low molecular weight A-C Polyethylene brings to the processing of natural and synthetic elastomers. 8 p.
**444V** Semet-Solvay Petrochem. Div.

**Polyethlene**....."Plastic for Chemical Engineering Construction—Polyethylene" details molecular structure of polyethylene & discusses its mechanical, electrical & chemical properties & characteristics.
**444W** American Agile Corp.

*From advertisement, this issue

**Polyvinyl Materials**.....Products made from Geon rigid vinyl include corrosion-proof pipe, fume ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. Offers technical information.
12 *B. F. Goodrich Chem. Co.

**Propylene Glycol**.....New 16 p. Folder presents data on physical and physiological properties, specifications, shipping containers, constant-boiling mixtures, solubilities, and applications. Data Folder F-8738.
445A Carbide & Carbon Chem.

**Resins, Coating**.....New booklet covers Plaskon urea & melamine coating resins for modern industrial baking enamel systems. Presents complete properties of these resins together with recommendations for use. 12 p.
445B Barrett Div.

**Resins, High Styrene**.....Darex 43G is an excellent rubber reinforcing resin for shoe soles, floor tiles, wire & cable insulation, mechanical molded goods. Characteristics, features, etc., in Brochure No. C-15.
445C Dewey & Almy Chem.

**Resins, Polyethylene**.....Illustrated, 16 p. answers numerous questions about Petrothene polyethylene resins: what is polyethylene? how is it made? what are its properties– what is it used for– how is it processed– etc.
445D U. S. Industrial Chem. Co.

**Resins, Polyvinyl Chloride**.....Describes Marvinol VR-30, a new & unique polyvinyl chloride resin designed especially for the calender industry. Covers properties, compounding & processing. Bulletin No. 2.
445E Naugatuck Chem. Div.

**Resins, Polyvinyl Chloride**.....Multigraphed Data Sheet lists physical properties of Diamond PVC-45 polyvinyl chloride resin, & cites its advantages for calendering of film & sheeting & other applications.
445F Diamond Alkali Co.

**Resins, Polyvinyl Chloride**.....Scrupulous attention to purity produces polyvinyl chloride resin that can be fabricated with complete confidence. Literature and product samples of Vygen available on request.
445G General Tire & Rubber Co.

**Resins, Resorcinol**.....Literature includes Specification Bulletins Nos. 300 and 300/1 on Synvaren PLS-Resorcinol Type Resins for the Woodworking Industry . . . for Bonding Other Materials Than Wood. 18 p.
445H Synvar Corp.

**Resins, Synthetic**.....Illustrated, 24 p. "Resin Review" (No. 15) includes sections on: Acryloid B-66, Amberlac 292X and Uformite MM-47 specialty coating resins; polyester-urethane foams; resin reactivity; etc.
445I Rohm & Haas Co.

**Silicates**.....20 p. booklet lists the grades of silicate of soda and other silicated alkalies manufactured by company, with certain properties, major uses and general data to acquaint users with the materials.
445J Diamond Alkali Co.

**Soda Bleach Solutions**.....48 p. Guidebook furnishes factual data on the general properties of hypochlorites, stability of hypochlorite solutions, the preparation of solutions, caustic soda solutions, etc.
445K Diamond Alkali Co.

**Soda, Caustic**.....“Caustic Soda Buyer's Guide” contains helpful facts on economics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc.
160b *Hooker Electrochem. Co.

**Sodium m-Silicate**.....Valuable data on Drymet anhydrous—the most highly concentrated form of sodium m-Silicate. Drymet File Folder contains complete technical information and suggested formulations.
T450 *Cowles Chem. Co.

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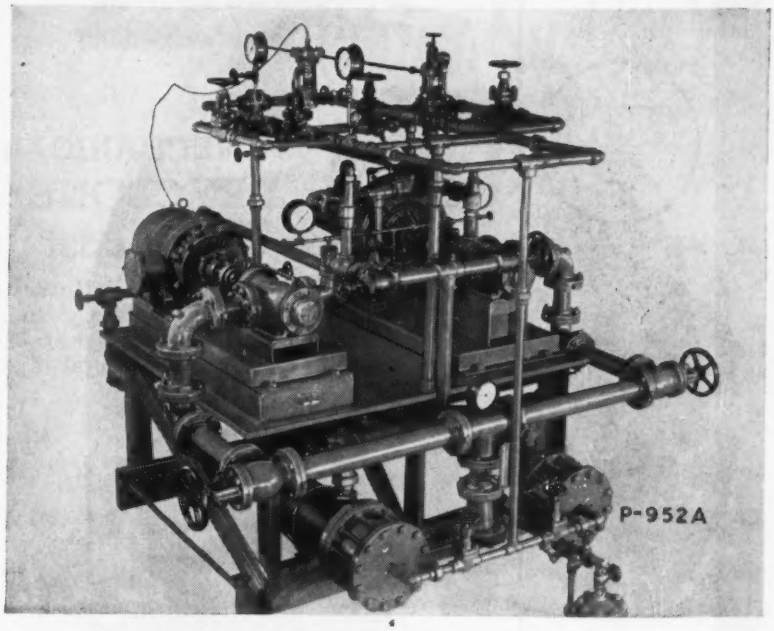


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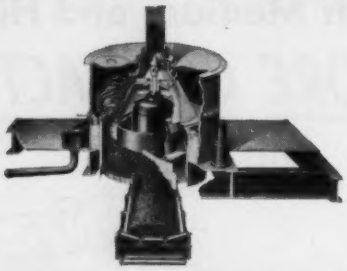

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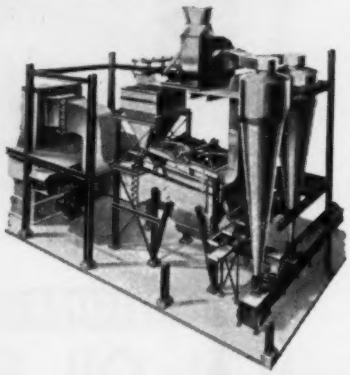

## . . . THERMAL
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## LITERATURE . . .

**Solvents**.....2-50-W Hi-Flash Solvent offers you: high flash point; good odor; high solvency power; coat tar origin; slow, even evaporation rate; attractive low price; etc. Request product samples and price data.
**446A** Neville Chem. Co.

**Solvents**.....Assure controlled evaporation. In paint & surface coating industry . . . solvents offer precise characteristics to meet your most exacting requirements. Full data on characteristics & specifications.
**73** *Esso Standard Oil Co.

**Solvents, Aromatic & Aliphatic**..... Epesol aromatic & aliphatic solvents are rigidly controlled for exceptional purity, uniformity & quality . . . to contribute to manufacture of top quality paint. Request Catalog.
**446B** Eastern States Chem. Corp.

**Solvents, Chlorinated**.....14 p. Bulletin furnishes technical information on Diamond chlorinated solvents. Included are: carbon tetrachloride, perchlorethylene, methylenechloride, chloroform, methyl chloride.
**446C** Diamond Alkali Co.

**Starches**.....Valuable 56 p. booklet, "The Story of Starches," completely describes the broad variety of National starches, the way they are produced, and the miracle of "man-made" starch derivatives. Request your copy.
**446D** National Starch Products.

**Sugars, Rare**.....Company announces the availability upon request of a valuable reference . . . a 24 p Catalog and Price List which features data on rare sugars, amino acids, biological chemicals, etc.
**446E** Pfanstiehl Labs.

**Surface Active Agents**.....Oronite surfactants offer utmost in uniformity & quality. New Alkane Technical Bulletin available to those interested in processing finished detergents from the basic raw material.
**131** *Oronite Chem. Co.

**Surface Active Agents**.....Illustrated, 28 p. covers Armour etho-chemicals—unique cationic & non-ionic surface active chemicals. Includes: chemical & physical properties; solubility data; applications; etc.
**446F** Armour & Co.

**Surface Active Agents**.....New Product Data reference describes the Surfynols . . . non-foaming nonionic surface active agents. Includes structure, members, availability, fields of application, properties, etc.
**446G** Air Reduction Sales Co.

**Surface Active Agents**.....The non-ionic surface active agent, Polyethylene Glycol 600 Mono Oleate, has been found particularly efficient as a foaming agent for polyurethane rigid foams. Data & product samples.
**446H** Glyco Products Co.

## Construction Materials

**Aluminum**.....Process Industry applications of aluminum for producing everything from beer to bomb shells are analyzed in illustrated, 80 p. book, "Process Industries Applications of Alcoa Aluminum."
**171** *Aluminum Co. of America

**Castings, Metal**....."Allegheny Metal Castings" furnishes valuable information on stainless castings: analyses; properties; technical data on handling & heat treatment; typical application; etc. 32 p.
**310** *Allegheny Ludlum Steel Corp.

**Cements, Insulating**.....Eagle-Picher One-Cote cement insulates, protects, finishes in one quick application. Cement is clean, easy to handle—provides a smooth, light-reflectant surface. Request free sample.
**74** *Eagle-Picher Co.

*From advertisement, this issue

**Coatings, Protective** ..... Announces availability of a new brochure on Laqua, new coating for metals that preserves chemically cleaned surfaces obtained directly after electro-plating or a chemical cleaning operation.
**447A** Fidelity Chem. Products Corp.

**Coatings, Protective**.....Describes application of Sprayed Metal Coatings to processing equipment, storing & shipping containers, tanks, tank cars, etc. for contamination & corrosion protection. Illustrated.
**447B** Metalweld, Inc.

**Fabrication, Metal**.....Booklet, "Facilities & Products," with information & photographs which show why company can turn out—at low cost—specialized heavy equipment for chemical plants, available upon request.
**332** *Newport News Shipbuilding.

**Fabrication, Metal**.....Manufactures metal products for many industrial uses . . . from complete carbon-black plants to steel conveyor boxes. Designs, engineers and fabricates to specific needs, Full data.
**366** *Boardman Co.

**Fabrication, Specialty**.....Presents fully illustrated brochure of fabricating facilities of a company which specializes in engineering and fabrication of specialty and custom-built equipment. Request Catalog No. 155.
**447C** Fritz W. Glitsch & Sons

**Fabrication, Stainless Steel**.....Offers quality workmanship, economical fabrication to the most exacting specifications . . . in large or small quantities. "Sheet and Plate Fabrication" & "Electrical Enclosures" on request.
**437** *Kirk & Blum Mfg. Co.

**Insulation**....."Johns-Manville Products Handbook" covers 11 lines of J-M products: insulations & refractory products; Transite asbestos-cement pipe; packings & gaskets; electrical products; etc. 52 p.
**399a** Johns-Manville.

**Insulation, Cellular Glass**.....Will give you the maintenance-free insulating performance you need for your piping, tanks, spheres and other industrial equipment. Request descriptive product booklets.
**21** *Pittsburgh Corning Corp.

**Insulation, Industrial**.....No matter where your insulation job may be—Armstrong can give you efficient, well-integrated, on-the-job service from original specs to final installations. Booklets describe full line.
**313** *Armstrong Cork Co.

**Insulation, Pipe**.....Amosite . . . the South African asbestos with long, strong, resilient fibers gives Unibestos pipe insulation greater strength and superior insulating ability. Information in Bulletin No. 109C.
**408** *Union Asbestos & Rubber Co.

**Laminates, Resin-Bonded**.....Pla-Tank resin-bonded laminate products for chemical-resistant service in metal finishing & chemical process industries. Data Sheets cover tanks, pipe, ducts, hoods, stacks, etc.
**L460** *Chemical Corp.

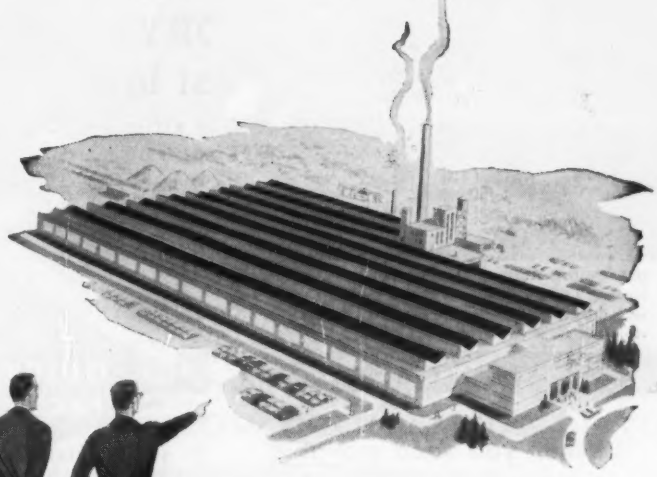
**Materials of Construction**.....Describes five materials of construction, unique in their high resistance to corrosion: porcelain; stoneware; coatings; graphite; & alumina. Details in Bulletin No. CHE-R5.
**447D** General Ceramics Corp.

**Plastic Sheeting, Vinyl**.....Plastispray can be sprayed on building surfaces of any size or shape to form a pliable sheeting of high tensile strength & elongation. Details in illustrated A.I.A. File 24-B.
**447E** Liquid Plastics Corp.

**Plastics, Tooling**.....Company announces the availability of an informative Mixing Chart which illustrates the amount of tooling plastic needed for a given job. Request "How to Figure Toolplastik Materials."
**447F** Rezolin, Inc.

*From advertisement, this issue


DO YOUR SCALES ADD UP TO A *Weighing System?*



**TODAY IT PAYS TO TAKE A PLANT-WIDE LOOK AT WEIGHING**

Do you have the *right* scales in the *right* places? A modern *Weighing System* works hand in hand with your accounting *system* and makes a *big* difference in helping you win your war on costs. Weight records that originate at scales flow to the accounting areas and directly affect costs, inventories and customer billings. Weighing errors cannot be corrected later—weights must be right the *first* time. That's why it's more than ever important to think of weighing not in terms of isolated scales, but as a vital part of your overall cost-control system.

If you would like to explore this in relation to your plant, why not drop us a line today? No obligation, of course.
Ask about the "weighing system plan."
Toledo Scale Company,
Toledo 1, Ohio.

# BARCO *Flexible* BALL JOINTS

*"Moves in Any Direction!"*

UNLOADING ACID—This 2" flexible unloading line for acid tank cars is made with the aid of two Barco Ball Joints in stainless steel with No. 11CT gaskets.

QUICK FACTS

## When you need movable joints in piping handling CHEMICALS

**Leading manufacturers** of all kinds of chemicals recommend use of BARCO BALL JOINTS wherever you must provide for *flexibility* or *movement in piping*. Here's why:

Barco's Bar-Ductile metal ball and casing offer good resistance to chemical action and corrosion. Where additional protection is desired, these parts can be supplied in stainless steel or virtually any alloy specified.

Barco's new No. 11CT gaskets are impervious to chemical action and maintain a tight seal without interfering with the easy turning action of the joint. No lubrication is required.

One Barco Ball Joint will do the work of two or more swivel joints because it *"moves in any direction."*

Barco Ball Joints can help you in many ways. Use them in your plant! Barco also makes revolving joints (for continuous higher speed rotation), swivel joints, and swing joints for other kinds of pipe movement. For complete information, write BARCO MANUFACTURING CO., 516N Hough Street, Barrington, Illinois.

**1. NO METAL-TO-METAL CONTACT BETWEEN MOVING PARTS.** An important Barco advantage where corrosive chemicals are present, either externally or internally.

**2. CHEMICALLY INERT GASKETS.** Barco offers a choice of seven types of gaskets including No. 11-CT for corrosive service. No lubrication required.

**3. STAINLESS STEEL BODIES.** Also regularly furnished in Bar-Ductile metal, Steel, Bronze, Aluminum. Other special and alloy joints to order.

**4. MAXIMUM FLEXIBILITY.** Up to 40° side flexibility with 360° rotating movement.

**5. PRESSURE SAFE! FIRE-PROOF! Unequalled for SAFETY** where flexible connections are required.

**6. MANY STYLES AVAILABLE.** Angle or straight; threaded or flanged connections. For pressures to 7,500 psi; temperatures to 1000°F. 15 different sizes. ¼" to 12".

• ASK FOR BULLETIN No. 215

# BARCO

*THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS*


## LITERATURE . . .

**Steels, Rubber-Lined**.....Ace rubber-lined steel . . . strength & pressures of steel plus chemical resistance of hard rubber. Excellent for alkalis, most inorganic acids, many organic acids, etc. Bulletin CE-52.
345c *American Hard Rubber Co.

**Steels, Stainless**.....Covers superior stainless steel sheets, strip, bars plates, wire, forgings, etc. Data in informative 44 p. booklet, "Making the Most of Stainless Steels in the Chemical Processing Industry."
239 *Crucible Steel Co. of America.

**Surfacing, Floor**.....Newest advancement in continuous search for better corrosion-proof materials — offers greater protection than conventional acid-proof floor materials. Trial sample of Corocrete on request.
362 *Cellcote Co.

**Titanium**....."Facts About Titanium" contains a list of commonly available titanium alloys & their compositions, forming & welding methods, heat treatment & machining data, current & projected prices, etc.
448A Arthur D. Little.

**Titanium**.....Shows resistance to chloride solutions and retains useful strength up to 800-1000F. Other advantages and data on application and fabrication of titanium alloys in descriptive Rem-Cru Review.
306 *Rem-Cru Titanium.

## Electrical & Mechanical

**Cutters, Tube**.....Describes a new push-type internal tube cutter . . . a time-saving maintenance tool that may be used with your present air or electric motor to cut non-ferrous tubes. Literature and data.
356 *Airetool Mfg. Co

**Drives, Adjustable Speed**.....Announces development of a precise adjustable speed drive for a wide field of applications. Covers features, ratings, speeds, sizes, etc., in illustrated Bulletin No. 4400-PRD-229.
448B Electric Machy. Mfg. Co.

**Drives, Control**.....New, small, piston-operated Bailey Control Drive will improve flow characteristics of butterfly valves, dampers, hydraulic couplings, feeders, etc. Specs. Nos. P81–1 and P81–5.
25 *Bailey Meter Co.

**Enclosures, Pushbutton**.....Describes the new Hoffman oil tight pushbutton enclosures. Includes: application; types available; mounting; construction; back mounted contact blocks; finish; specifications; etc.
448C Hoffman Engrg. Corp.

**Gaskets, Teflon**.....The ideal seal for many process applications is a Flexitallic gasket with teflon trapped between edges of stainless steel. For complete data request folder, "Teflon in Flexitallic Gaskets."
338 *Flexitallic Gasket Co.

**Gaskets, Teflon-Jacketed**.....Fully illustrated reference covers Chempro's lines of teflon jacketed gaskets, solid ring gaskets, teflon expansion joints and special teflon, gaskets. Request Bulletin No. CP553.
R373 *Chemical & Power Products.

**Motors**.....Feature extra motor value: double-shielded bearing; large grease reservoirs; bolted-on bearing cap; labyrinth seals. For complete information on maintenance-cutting design, see Bulletin 51B7286.
71 *Allis-Chalmers Mfg. Co.

**Motors**.....Describes newly designed standard & explosion-proof enclosed motors, featuring corrosion-resistant cast iron frames, improved winding insulation & heavy duty ball bearings. Bulletin No. MU-203.
34 *Wagner Elec. Corp.

*From advertisement, this issue

**Motors**.....Howell part winding motors offer low cost 2 or 3-step starting. For full information—current & torque data for horsepowers from 5 to 200 hp as well as typical installation data—see Bulletin No. PW-1.
**449A** Howell Elec. Motors Co.

**Packings**.....Definite savings in maintenance cost . . . when you use spiral or die-molded ring packings. Means long uninterrupted sealing service with less wear on rods, shafts, sleeves or stems. Bulletin File DMCE.
**BL377** *Durametallic Corp.

**Packings, Carbon**.....The application of carbon "Paragrid" packings to all problems of absorption, scrubbing, distillation, gas cooling, etc., offers numerous advantages. For details, see brochure, Ref. C7/54.
**449B** Powell Duffryn Carbon Prod.

**Rims, Sprocket**.....Operation of overhead valves solved thru use of Babbitt adjustable sprocket rim with chain guide. Fits any valve wheel—quickly installed—low in cost. Offers descriptive product literature.
**TL377** *Babbitt Steam Specialty Co.

**Seals, Mechanical**.....Flexibox mechanical seal features numerous advantages: extreme simplicity; great sturdiness; low cost; universally adaptable; etc. For information, request illustrated Bulletin No. 10.
**457** *Sealol Corp.

**Starters, Motor**.....Built in wide range of ratings for squirrel-cage, wound-rotor & Synchronous motors . . . for full or reduced voltage . . . reversing or non-reversing. Details in Bulletin No. 14B6410B.
**333** *Allis-Chalmers Mfg. Co.

**Teflon Products**.....Illustrated booklet, "The Best in Teflon," covers data on teflon parts & products—bellows, bellows connectors, pump & valve packings, tubing & other molded forms. 12 p. Chemlon Catalog.
**343a** *Crane Packing Co.

**Turbines, Steam**.....Turbines range from 150 horsepower down to fractional in 6 frame sizes. Feature large number of manually operated valves for individual control of steam nozzles. Details in Bulletin 135.
**257** *Coppus Engrg. Corp.

## Handling & Packaging

**Conveyor Systems, Pre-Engineered**..... New line (Install-Your-Own) includes light-duty wheel gravity as well as medium & heavy-duty roller gravity conveyor sections in all standard widths. Detailed literature.
**449C** Lamson Corp.

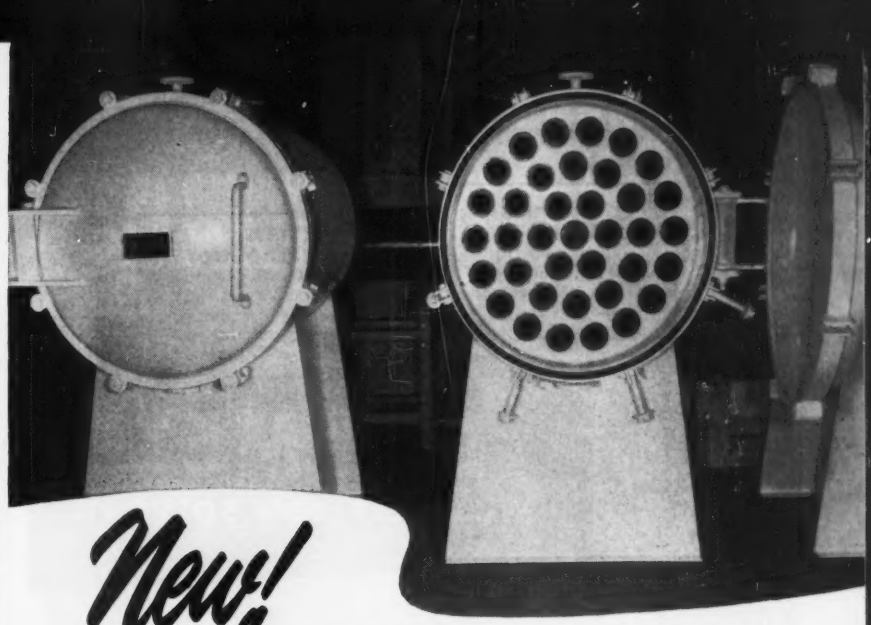
**Conveyors, Aluminum**.....Easy-to-handle, durable and economical Ferguson aluminum gravity roller and gravity wheel conveyors are completely illustrated and described in a new, 4 p., two-color reference.
**449D** Harry J. Ferguson Co.

**Conveyors, Multi-Tier**.....Convert heating, cooling, drying and similar operations from batch to continuous processing. Process products under exact time, temperature and atmospheric control. 8 p. Bulletin.
**440** *J. W. Greer Co.

**Drums, Magnetic**.....For the automatic removal of tramp iron or ferrous material from gravity or conveyor transported products. Includes diagrams, performance data, application guides, etc., in Bulletin MD-200.
**449E** Homer Mfg. Co.

**Magnets**.....Presents the all-new Dings Dynamic Perma-Plate Magnets . . . for efficient—low cost tramp iron removal. Describes the numerous features and advantages of versatile magnets in Catalog No. 1205-D.
**307** *Dings Magnetic Separator Co.

*From advertisement, this issue

*New!*

# TUBULAR FILTERS
## *by Industrial*

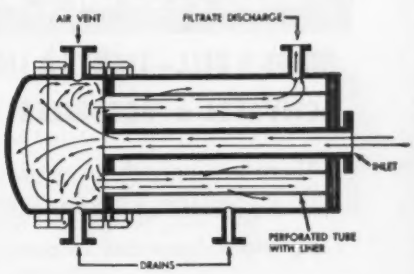
**WITH IMPORTANT NEW FEATURES DUE TO FLOW FROM INSIDE OF TUBE**

- ★ **Unequaled simplicity of maintenance.**
- ★ **Solids can be recovered in dry form.**
- ★ **Liners are easy to replace and inexpensive.**
- ★ **Ideal for intermittent or continuous operation.**
- ★ **Chamber can be emptied without losing cake.**
- ★ **No unfiltered "heel".**
- ★ **Can be used with or without pre-coat.**
- ★ **Ideal for polishing . . . as a trap filter . . . and as a scavenger for larger filters.**

**NEW SIMPLIFIED OPERATION**
The filter is prepared for use by simply rolling flat sheets of filter paper and inserting them in the tubes, which are designed to force the paper snugly against the tube wall.

**EASY TO CLEAN**
Filter papers are simply withdrawn and replaced. Even the tubes are easy to remove, being held in place by a simple rubber O-Ring device. Except for the cover there are no nuts and bolts to handle.

**FLOW DIAGRAM**




***FOR FULL DETAILS WRITE FOR BULLETIN TS-160-755.***

CENTRIFUGAL PUMPS · PRESSURE FILTERS · ION AND HEAT EXCHANGERS · RUBBER LININGS · WASTE TREATING EQUIPMENT

*Industrial*

**INDUSTRIAL**
**FILTER & PUMP MFG. CO.**
5918 OGDEN AVENUE • CHICAGO 50, ILLINOIS

**LOWER COST?**
DRYMET—*anhydrous* sodium metasilicate, provides *more* detergent power.

**BETTER DETERGENCY?**
DRYMET puts more genuine colloidal punch into your cleaning compounds.

**GOT A DETERGENT COMPOUNDING PROBLEM?**

# DRYMET

**WILL HELP YOU SOLVE IT...**

**pH CONTROL?**
DRYMET buffers alkali. Pegs the pH where you want it.

## and COWLES Know-How Will Help, Too

Years of experience in detergent manufacture—

Detergent research laboratories—

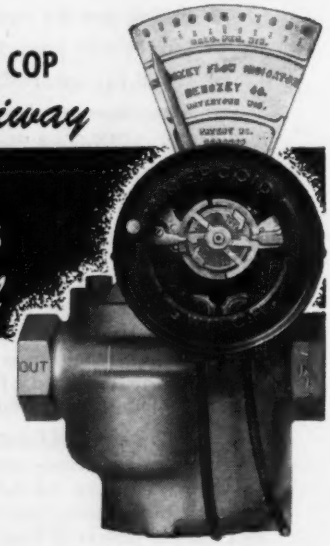
To use DRYMET more effectively

**Send for this DRYMET File Folder**
—Properties of DRYMET
—Recommended DRYMET Formulations
—How to improve *your* products

*Cowles* **CHEMICAL COMPANY**
7022 Euclid Avenue — Cleveland, Ohio

**A FULL TIME TRAFFIC COP**
*on your fluid hiway*

**HENSZEY FLOW METERS**
*with Alarm Control*




**RINGS A BELL—LIGHTS A LIGHT or ACTIVATES a MOTORIZED VALVE**

There are only three moving parts in the HENSZEY FLOW METER — no breakdown due to complicated gears and mechanism. Goes right in the line — no additional supports. Indicates flow within 3% absolute accuracy, even with pulsating flow. Send for bulletin.

**SOUND ALARM AT HIGH OR LOW FLOW!**

Easy to set on face of switch — unaffected by dust, dirt or corrosion — no pitting or sticking.

**HENSZEY COMPANY**
DEPT. E-12 — WATERTOWN, WISCONSIN


## LITERATURE . . .

**Magnets, Rectangular Separation**.....New bulletin on Ohio Super Magnetomotive rectangular separation magnets. Includes performance data, line drawings, schematic & dimensional diagrams, etc. Catalog No. 114.
**450A** Ohio Elec. Mfg. Co.

**Materials Handling**.....When time is important in handling dry materials in bulk . . . rely on Fuller systems (Fuller Kinyon Airveyor, Airslide, Fuller-Fluxo). Data in "How To Pull Dollars Out of Thin Air."
**398** *Fuller Co.

**Materials Handling, Bulk**.....New, fully illustrated Folder describes case studies covering bulk handling of flour, sugar, cake mixes, carbon black, phosphor powders, cement, and 17 other basic materials.
**450B** Tote System

**Materials Handling Equipment**.....A new and completely revised booklet features engineering and application data on versatile line of overhead materials handling equipment. Request illustrated Bulletin 2008-L.
**450C** Cleveland Crane & Engrg. Co.

**Panels, Pulsating**.....Automation starts with PneuBin. It will solve your flow stoppage problems and reduce your operating expense. Request informative product literature and a "Flow Stoppage Report."
**466** *Gerotor May Corp.

**Scales, Pulp Density**.....Developed to overcome disadvantages of other methods of determining density, specific gravity of pulps, liquids & dry solids, & percent solids of pulps. Covers features & operation. 4 p.
**450D** Mine & Smelter Supply Co.

**Trucks, Pallet**.....The shortest "walkie" electric pallet truck on the market—only 25⅞" longer than the fork length—is fully described with photographs, drawings & specifications in new Circular, No. 34C.
**450E** Lewis-Shepard Products.

## Heating & Cooling

**Air Handling & Conditioning Equipment**.....72 p. "Clarage Air Handling and Conditioning Equipment Service Manual" furnishes valuable material adaptable to virtually any air handling or conditioning job.
**55b** *Clarage Fan Co.

**Boilers**.....Beat the penalties of boiler obsolescene—with a modern Cleaver-Brooks installation. Sizes from 15 to 600 hp, 15 to 250 psi—steam or hot water, for heating or processing. See Catalog.
**267** *Cleaver Brooks Co.

**Burners**.....With "Surface" Automatic Proportioning, the precise amount of air required for complete combustion is constantly mixed with the gas. For complete information, request Bulletin No. H55–5.
**R462** *Surface Combustion Corp.

**Coolers, Cascade**.....Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radiused returns for low pressure drop as well as redwood waterguide strips. Catalog Section No. S-6820.
**235c** *National Carbon Co.

**Dowtherm Systems**.....Wherever you need industrial or process heating, with pinpoint temperature control in the 350F to 700F range, low-pressure Dowtherm systems offer many advantages. Bulletin ID-54-5.
**129** *Foster Wheeler Corp.

**Generators, Steam**.....Describes the pre-engineered, standardized steam generators offered in 9 sizes, with capacities of from 50,000 to 150,000 lb. per hr. Includes drawings & design features. Bulletin B-55-4.
**450F** Foster Wheeler Corp.

*From advertisement, this issue

**Generators, Steam**.....The Vogt Class VV steam generator is a reliable, safe & completely portable shop-assembled water tube boiler of extremely simple & compact design. Details in illustrated Bulletin PSG-2.
**451A** Henry Vogt Mach. C

**Heat Exchangers**.....Describes Polybloc graphite heat exchanger . . . with unique design features that eliminate cemented joints & product continuous turbulence. Includes characteristics, operation, etc. Bulletin 6550.
**451B** Carbone Corp.

**Heat Exchangers**.....The G-R Plate Fin Exchanger is a compact cross-flow heat exchanger with extended surface on both sides, and has been designed primarily for gas-to-gas service. See "G-R News" (Summer 1955).
**451C** Griscom-Russell Co.

**Heat Exchangers**.....Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740.
**235c** *National Carbon Co.

**Heat Exchangers**.....Covers complete line of Karbate brand impervious graphite shell & tube heat exchangers. Engineered for maximum corrosion resistance & minimum maintenance. Catalog Section No. S-6840.
**235d** *National Carbon Co.

**Heat Transfer Apparatus**.....Now . . . you can recover heat from gases at extreme temperatures. Bulletin covers design, construction & applications of G-R High-Temperature K-Fin Heat Transfer Surface. Bulletin 1400.
**386** *Griscom-Russell Co.

**Heat Transfer Surfaces**.....Brochure contains engineering data and application information on Inner-Fin surface . . . applicable wherever any type of heat exchange is required. Illustrated Bulletin No. 850.
**451D** Bush Mfg. Co.

**Heaters, Distilled Water**.....Furnishes complete information on distilled water heater which heats distilled water automatically. Covers construction details and electrical requirements. Bulletin No. 132.
**451E** Barnstead Still & Sterilizer.

**Heaters, Gradiation**.....Makes available detailed literature—"Try the Gradiation Heater for Economical Ethylene Production" and bulletin, "Gradiation Heating for Petroleum and Chemical Processing."
**158** *Selas Corp. of America.

**Heaters, Immersion**.....New electric radiant translucent fused quartz immersion heater designed to solve difficult problems encountered in heating of acid electroplating & pickling solutions. Request Bulletins.
**451F** Glo-Quartz Elec. Heater Co.

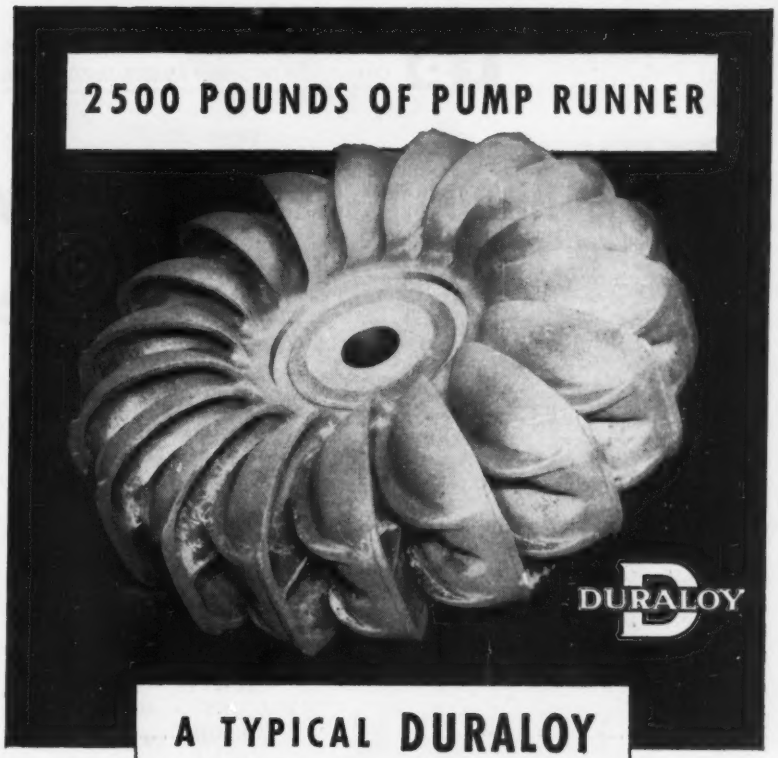
**Heating Elements, Electric**.....New 24 p. booklet features tubular, strip, water & oil immersion types & domestic water heating elements in both standard & custom-made design. Illustrated Publication EC-53.
**451G** Cutler-Hammer.

**Heating Units, Digester Sludge**.....Illustrated, 20 p. describe the HEATX digester sludge heating unit. Includes complete details on the application, construction and operation of the HEATX. Bulletin No. 24S82.
**451H** Walker Process Equipment.

**LP-Gas Plants, Packaged**.....Company announces the development of a self-contained, fully automatic, packaged LP-Gas plant for industrial and utility use. Complete information supplied in Bulletin GP-150.
**451I** American Liquid Gas Corp.

**Pumping & Heating, Fuel Oil**.....Gives information on fuel oil pumping & heating units designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" oil & residums. Bulletin 40.
**445** *National Airoil Burner Co.

*From advertisement, this issue


A TYPICAL DURALOY HIGH ALLOY CASTING

This casting is 18-8, destined for use under quite corrosive conditions. It's typical of the work done in our modern foundry for both manufacturers who need high alloy castings for their equipment and for plant operators who need castings to meet a corrosion problem, a high temperature problem or a combination of both, with or without abrasion as a contributing factor.

We here at Duraloy now offer several distinctly different kinds of castings, all in the corrosion-resisting, heat-resisting or abrasion-resisting class and each kind offering certain distinct advantages:

static sand castings

centrifugal castings

shell molded castings

Shell molding offers great economy in the casting of small pieces on a large mass production basis.

Bring *your* high alloy casting problem to Duraloy both for recommendations as to the best alloying combination and for foundry services in casting and finishing the piece. Our recommendations and service are backed up by more than thirty years high alloy casting experience.

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FP *complete process instrumentation*

# Announcing F&P'S New Force-Balance Transmitter

F&P's new differential pressure transmitter

## Sealed diaphragm differential pressure transmitter

F&P is proud to announce a brand-new, trouble-free pneumatic oil-sealed flow transmitter. With the F&P Transmitter, it is now possible to measure differential pressure instantaneously and accurately. No working parts contact the process fluid. The fluid pressures are exerted on the smooth outside surfaces of two diaphragms which transmit pressure differential through a sealed-in oil chamber between them.

### These are its features:

- All working parts sealed from process fluid
- Outstanding stability and rigidity for maximum accuracy, minimum adjustment
- Meter body and transmitter are separate assemblies for greater accuracy, and for easier adjustment or maintenance
- Adjustable damping built into meter unit to minimize pulsation and vibration effects before they reach the transmitting half of the instrument
- Process fluid enters only two smooth, pocketfree cylindrical chambers
- Internal hydraulic temperature compensation

**FISCHER & PORTER COMPANY**
COUNTY LINE ROAD • HATBORO 6, PA.

Measuring, recording and controlling instruments
Centralized control systems
Data reduction and automation systems
Chlorination equipment
Industrial glass products

*Sales offices in 32 American cities and in principal cities abroad*

## LITERATURE . . .

**Sprayed Coil Equipment**.....24 p. of data covering new line of Clarage Unicoil Units. Principally designed for cooling & dehumidifying service in central station systems. Features & advantages in Catalog No. 411.
**55a** *Clarage Fan Co.

**Towers, Cooling**.....New 20 p. booklet, "Test Your Tower," describes simple direct method by which purchaser of industrial cooling tower can assure himself that he will receive performance exactly as specified.
**9** *Marley Co.

**Traps, Steam**.....Company's product line features long trap life with infrequent maintenance. Makes available on request a 44 p. Steam Trap Book with practical information designed to give you better trapping.
**38** *Armstrong Mach. Wks.

**Traps, Steam**.....The right steam trap for light condensate loads . . . Yarway 20-A Impulse Steam Trap. Features small size, stainless steel body & working parts, low cost, etc. Bulletin T-1739-X.
**155** *Yarnall-Waring Co.

**Traps, Steam**.....Design superior in retaining prime under most difficult operating conditions: light loads, rapid pressure drops & partial vacuum in return line caused by night shut-downs. Bulletin 360-A.
**452A** Sarco Co.

**Traps, Steam**.....In toughest chemical processing service, Nicholson pays off 4 ways: lower initial cost; less upkeep expense; faster warm-up; faster production. For complete trap data, request Catalog No. 953.
**26** *W. H. Nicholson & Co.

**Traps, Steam**.....Straight-through steam trap design saves time & fittings for Jones & Laughlin Aliquippa Wks. If you're interested in straight-through piping, request 36 p. book, "Solving Steam Trap Problems."
**452B** V. D. Anderson Co.

**Vaporizers, Dowtherm**.....International-LaMont dowtherm vaporizers provide accurate temperatures from 500°-750°F for the process industries. Specific features of advanced design described in Bulletin.
**452C** International Boiler Wks. Co.

## Instruments & Controls

**Conductivity Equipment, Electrolytic**.... New reference lists a wide range of standard instruments and conductivity cells including the most recent developments in both bridges and cells. Catalog No. 22.
**452D** Industrial Instruments.

**Controllability Analysis, pH**.....Unique Analysis gives vital data about controllability factors of individual waste treatment processes. Outlines approach in company's Process Data Sheet No. 700(2).
**281** *Leeds & Northrup Co.

**Controllers, Electric Proportional**..... Widely used for control of dew point, pressure, temperature, etc., in batch process, combustion atmosphere & heat treating furnace applications. Details in Bulletin No. 4-11.
**452E** Foxboro Co.

*From advertisement, this issue

**→ Want more information on any of these items? Just circle its code number on the postcard inside the back cover, then mail to us. It's that easy now.**

**Controllers, Humidity**.....Offer many features: lowest priced electric hygrometer humidity controller; small size; automatic; no re-calibration required; easy to wire & set; etc. Details in Bulletin No. 2273.
**453A** American Instrument Co.

**Controllers, Thermostatic Pilot**.....Describes new Fultrol Thermostatic Pilot Controller No. 1100. Provides accurate control of liquids or air temperature when used in conjunction with valves, dampers, etc.
**162–3a** *Fulton Sylphon Div.

**Controls Level**.....Tektor level control indicates or controls level of fluids, powder, solids (conducting or non-conducting). Features low first cost . . . low operating cost. Request informative literature.
**353e** *Fielden Instrument Div.

**Fractometers, Vapor**.....Employing the principles of gas chromatography, P-E's new vapor fractometer is a revolutionary advance in the field of gas and volatile liquid quantitative analysis. See Bulletin.
**371** *Perkin-Elmer Corp.

**Gages**.....Announces new line of small-size, easy-to-read gages & receivers. Important features: 5 in. illuminated scales; independent, interchangeable units; easily mounted; etc. Data in Bulletin V5.
**170** *Republic Flow Meters Co.

**Gages, Tank**.....Company makes available pertinent information on their line of 100% automatic Liquidometer tank gages for gaging liquids of all kinds. Gages are approved by the Underwriters' Laboratories.
**T454** *Liquidometer Corp.

**Indicators, Electronic Level**.....For accurate, continuous level measurement of liquids or divided solids. Feature savings in initial cost and in maintenance. Complete new instrument information available.
**353d** *Fielden Instrument Div.

**Indicators, Self-Balancing**.....Describes new T-E instrument . . . a self-balancing indicator with built-in key-type or push button switches. Includes function, design, operation, etc., in Catalog No. 61-E.
**444** *Thermo Elec. Co.

**Instruments**.....To regulate & record—temperature, pressure, vacuum, time . . . choose mechanical instruments by Weston. Describes line, noted for long-time accuracy & dependability. Illustrated Catalog No. M2A.
**60** *Weston Elecl. Instrument Corp.

**Measurement, Packaged Precision**..... For complete and detailed information on SR-4 Device applications and instrumentation, request company's new product literature: Bulletins Nos. 4300, 4301, 4302, 4306.
**49** *Baldwin-Lima-Hamilton Corp.

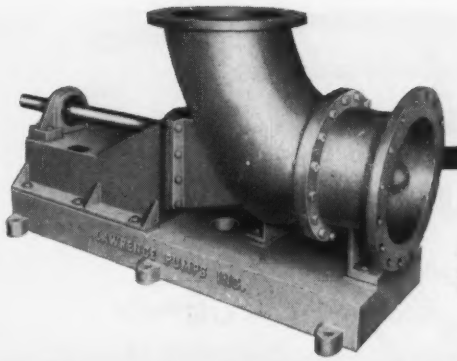
**Meters, Flow**.....Feature simple design with only three moving parts—no breakdown due to complicated gears and mechanism. Indicate flow within 3% absolute accuracy, even with pulsating flow. Detailed Bulletin.
**B450** *Henszey Co.

**Meters, Flow**.....Hays Veriflow meter accurately measures, indicates and totals flow of corrosive and hard-to-meter liquids without using weigh tanks, orifice plates or gage sticks. See Pub. No. 53-766-38
**79** *Hays Corp.

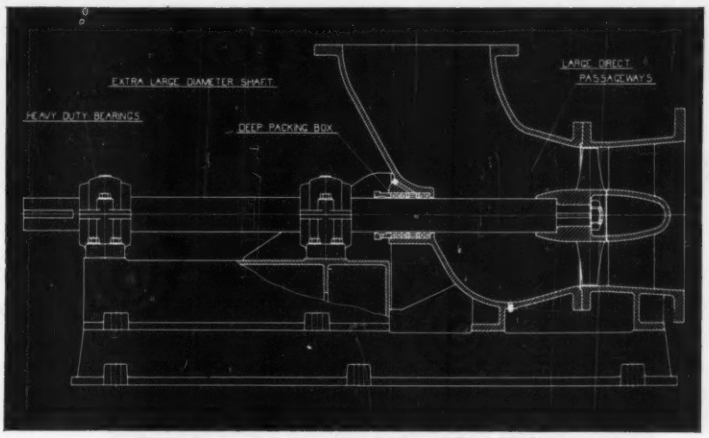
**Meters, pH**.....Self-contained, compact, light but sturdy in design, Model 125 is suited not only for the laboratory but also for plant and field use. Complete information on features in Bulletin No. 118.
**453B** Photovolt Corp.

**Recorders, Temperature, Resistance**..... Fielden Resistance Temperature Recorder features: convenient AC operation; simplified unitized design; etc. Makes available complete data on instrumentation.
**353c** *Fielden Instrument Div.

*From advertisement, this issue

Lawrence 24" Horizontal Circulating Pump of Nickel Alloy Construction




Cross Section of Lawrence Horizontal Propeller Pump

**PROPELLER PUMPS**
**FOR THE**
**CHEMICAL and PROCESS INDUSTRIES**

Lawrence Propeller or Axial Flow Pumps are widely used to circulate large volumes of liquid or slurry against low heads as in evaporators, crystallizers, etc. This type of pump is particularly well adapted for circulating service because of its simplicity, high efficiency, and low first cost. The flow can be arranged in either direction and the casing turned to any position desired to serve as an elbow. The capacity can be closely regulated by varying the speed—very important in crystallization processes where a uniform velocity must be maintained.

Lawrence Propeller Pumps are made of the metals and alloys best suited for their ability to resist the corrosive and abrasive action of the liquid pumped.

Write for Bulletin 203-6 for summary of acid and chemical pump data.

**LAWRENCE PUMPS INC.**

371 MARKET STREET, LAWRENCE, MASS.

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LIQUIDOMETER
Tank Gauge
• FOR GAUGING LIQUIDS OF ALL KINDS
• 100% AUTOMATIC
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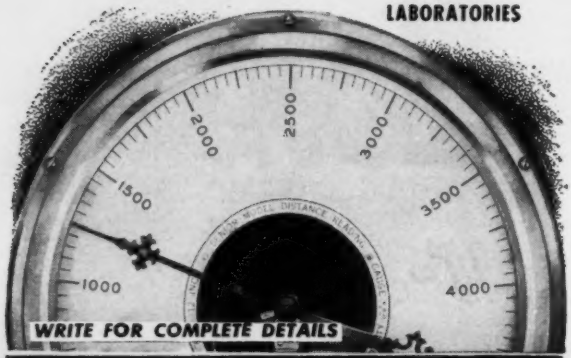


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36-29 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

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for all filtering and straining applications.
All meshes, all weaves, all alloys.

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THE C. O. JELLIFF
MANUFACTURING CORP. SOUTHPORT, CONN.

## LITERATURE . . .

**Regulators, Temperature**.....Describes No. 999 Temperature Regulator—for accurate control of industrial process temperatures, storage water heaters, bottle washers, slashers, etc. Sizes ¼" to 4" inclusive.
162-3c *Fulton Sylphon Div.

**Spectrophotometers**.....Versatile and accurate, the G-E spectrophotometer has a range of 380 to 700 millimicrons. Instrument will measure both transparent and opaque samplings. Data in Bulletin No. GEC-307.
39 *General Electric Co.

**Test Equipment**.....Describes instruments for servicing TV, radio & other communications equipment, as well as all industrial electronic and electrical equipment. Request fully illustrated, 16 p. Catalog R36A.
454A Weston Elecl. Instrument.

**Transmitters**.....The same Tel-O-Set transmitter can be used for temperature, absolute pressure or gage pressure . . . in all ranges. For complete information on features, request Bulletin No. 7280.
250–1 *Minneapolis-Honeywell.

**Transmitters, d/p Cell**.....Pioneered by Foxboro seven years ago . . . the d/p Cell Transmitter established a new standard of performance in flow measurement and control. Describes design features in Bulletin 13-11.
98-9 *Foxboro Co.

## Pipe, Fitting, Valves

**Elbows, Long Tangent**.....Feature many advantages: save pipe; often eliminate short nipples and their extra welds; save time and money in lining up an clamping pipe and fitting; etc. Catalog No. 54.
159 *Midwest Piping Co.

**Fittings**.....Offers Klinger Master Catalog describing the complete range of products . . . compressed absestos sheet packings for all purposes, valves, cocks, level gages, synthetic and silicone rubbers, etc.
135a *Klinger Corp. of America

**Fittings, Forged Stainless & Alloy Steel**.....High strength screw-end & socket-welding fittings available in a variety of alloy materials for high temperature & Corrosive services. Bulletin No. S-1-55.
365 *Watson-Stillman Fittings.

**Fittings, Stainless Steel**.....Company's line of Speedline stainless steel fittings cut costs . . . simplify pipeline design and assembly. Complete information in new, illustrated booklet, "Speedline Fittings."
TR460 *Horace T. Potts Co.

**Joints, Ball**.....Leading manufacturers of all kinds of chemicals recommend use of Barco Ball Joints wherever you must provide for flexibility or movement in piping. Details of line contained in Bulletin 215.
448 *Barco Mfg. Co.

**Nozzles, Spray**.....Company makes available on request a completely detailed Catalog which provides valuable data on Spraco Nozzle line. Includes information on full cone, flat spray & hollow cone types.
BL373 *Spray Engrg. Co.

**Pipe & Fittings**.....For corrosion-resistant piping. Impervious graphite pipe & fittings readily installed, long lasting, easily maintained, unaffected by most corrosive fluids. Catalog Section No. S-7000.
235b *National Carbon Co.

**Pipe & Fittings Glass**.....Glass Pipe & fittings for full-scale production operations. Strengthened by end-tempering & feature corrosion-resistance, non-contamination, etc. Catalogs EA-1 & EA-3 offer full data.
232-3a *Corning Glass Wks.

*From advertisement, this issue

**Pipe, Fittings & Valves, Impervious Graphite**.....Fully illustrated 12 p. covers line of Impervite impervious graphite pipe, fittings & valves. Also heat exchangers, pumps, coolers, towers, etc. Catalog No. 965.
**455A** Falls Industries.

**Pipe Installation, Glass**..... Makes available fully illustrated literature describing the simple procedures involved in laying out and plumbing Pyrex brand glass pipe. Request copy of "Installation Manual."
**232–3b** *Corning Glass Wks.

**Pipe, Plastic**.....General-purpose moderately priced rubber-plastic pipe handles most common chemicals to 170°F . . . except few strong acids & organic solvents. Tough, odorless, tasteless. Bulletin No. 80.
**344a** *American Hard Rubber Co.

**Pipe, Plastic**.....Announces the availability of new literature covering Kralastic and Tenite plastic pipe. Provides specific technical information on oil field applications of both types of plastic pipe.
**455B** Southwestern Plastic Pipe Co.

**Pipe, Saran**.....An old stand-by with many new uses . . . odorless, tasteless, general-purpose rigid pipe & semiflexible tubing. Highly resistant to most chemicals. Find complete details in Bulletin No. 351.
**345d** *American Hard Rubber Co.

**Tubing, Flexible**.....Hundreds of applications in the steam and Diesel power fields are filled by Penflex flexible tubing. For complete information on product line, request copy of "Flexineering" booklet.
**52** *Pa. Flexible Metallic Tubing.

**Valves**.....Describes "Little Richard" on-off valve: solenoid operated; piston type; pneumatically operated. Rugged new valve adaptable for high pressure service. For details, request Bulletin No. 4062-C.
**T438** *American Instrument Co.

**Valves**.....Shear-Seal valves catalogued by major service condition: air, oil, water. Three Bulletins include valve characteristics, flow patterns, overall dimensions; etc. Request Nos. A-5, O-5, and W-5.
**455C** Barksdale **Valves**.

**Valves**.....Rockwell-Built Edward forged & cast steel valves reduce maintenance costs, replacement inventories, get longer, more dependable service. For full details, see Edward Condensed Catalog.
**468** *Edward Valves.

**Valves**.....There's an Ace hard rubber, rubber-lined, or plastic-lined valve for every corrosion application. Sizes from 2" to 24". Diaphragm, gate and check types. Lists chemicals handled in Bulletin CE-52.
**345b** *American Hard Rubber Co.

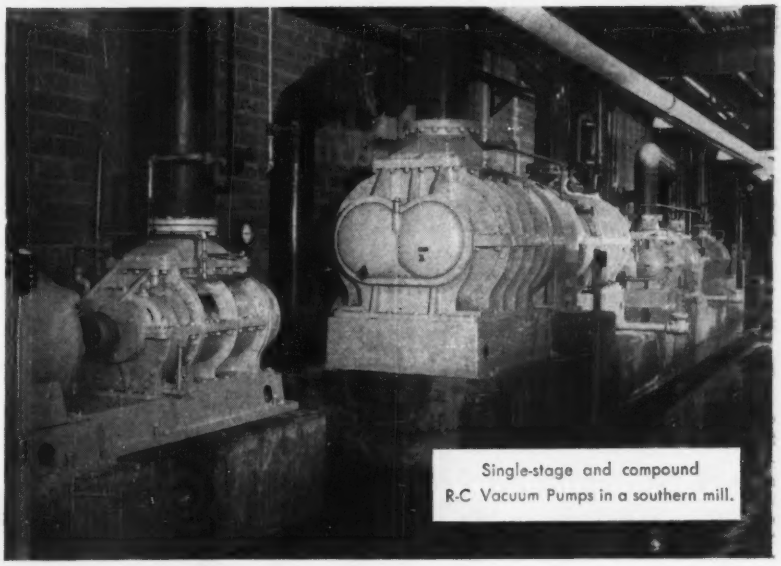
**Valves, Bellows Motor**.....Valuable data on the new Bellows Motor Valve —No. 992-D Series for final control element in pneumatic or hydraulic control systems to regulate flow of gas, oil, water or other liquids.
**162–3b** *Fulton Sylphon Div.

**Valves, Butterfly**.....New comprehensive Catalog—in loose-leaf form—includes a description of each valve, with specifications, layout drawings & dimensions of standard valves in each pressure rating. 48 p.
**455D** S. Morgan Smith Co.

**Valves, Control**.....For fluid control—the new Foster control valve with Isoforce actuator . . . gives you more power when you need it. Available in sizes starting at ¼". Details in Bulletin CV-1.
**394** *Foster Engrg. Co.

**Valves, Control**.....Illustrated folder describes a considerable number of Schade automatic regulating valves for level & pressure control of steam —air—gas—oil—water. Request your copy of Folio No. 4.
**455E** Schade Valve Mfg. Co.

*From advertisement, this issue

Single-stage and compound R-C Vacuum Pumps in a southern mill.

# R-C *plur-ability* PAYS OFF IN VACUUM PUMP PERFORMANCE

***For moving gas or air, call on R-C plur-ability***

Centrifugal and Rotary Positive Blowers, Gas Pumps and Exhausters

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Spiraxial® Compressors

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***Send for details and informative bulletins.***

Important operating factors, which add up to *R-C plur-ability*, account for the rapidly increasing use of Roots-Connersville Positive Displacement Vacuum Pumps for industrial processing.

- **Reduced horsepower at higher speeds** (600 rpm and up) creates power savings up to 25% and far lower first cost of motors.
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To see how leading industrial users make a profit from *R-C plur-ability*, write for details, in Bulletin 50-B-13.

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PROCTOR CONTINUOUS CONVEYOR DRYER
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Yeast requires sensitive drying methods. This Proctor & Schwartz installation at National Yeast Company maintains the uniform quality, color, and viability of the yeast at considerably increased drying rates.

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- Continuous Conveyor Systems
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**Manufacturers of Industrial Drying Equipment and Textile Machinery**

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**LITERATURE . . .**

**Valves, Diaphragm**.....From antibiotics to the toughest acids, alkalis and salts, there is a combination of Hills-McCanna body and diaphragm materials that will best suit your needs. Request Valve Catalog.
**467** *Hills-McCanna Co.

**Valves, Diaphragm** ..... Trouble-free plastic diaphragm valves—choice of general-purpose Ace-Ite, Ace Parian (polyethylene) or Ace Saran. Handles most corrosive chemicals & food ingredients. Bulletin 351.
**344b** *American Hard Rubber Co.

**Valves, Diaphragm Control**.....Throughout the entire range of valve travel—positioning is accurate & undistorted—control increments are finer with minimized positioning error. Full details in Bulletin CV-53.
**381** *Kieley & Mueller

**Valves, Drain**.....Offers descriptive information on line of Strahman ram type valves . . . the only drain valves that cannot clog up. Made in any cast metal to meet your requirements. Request complete Catalog.
**BL375** *Strahman Valves

**Valves & Fittings, Drop Forged Steel**.....400 p. book describes complete line of drop forged steel valves, fitings, & flanges for oil, steam, water, air, gas & refrigeration services. Catalog No. F-9.
**174** *Henry Vogt Mach. Co.

**Valves, Gate**.....Offers data on sturdy, small forged steel gate valves. Superhardened gate and seats assure tight closure, smooth operation and low maintenance. Complete information offered in Catalog No. 10.
**48** *Chapman Valve Mfg. Co.

**Valves, Lubricated Plug**.....36 p. covers complete line of iron and steel lubricated plug valves available. Many illustrations of single, screwed and bolted gland type valves are shown. Request Catalog No. PV-4.
**231** *Wm. Powell Co.

**Valves, Nickel Iron**.....Designed for chemical process industries, valves are recommended for control of mildly corrosive liquids with minimum quantities of mineral acids. Details in Bulletin No. 118.
**249** *Jenkins Bros.

**Valves, Plug**.....For special services—handling products that will harden or congeal at ordinary temperatures—Wedgeplug Valves can be supplied steam-jacketed. Offers full details in Wedgeplug Catalog 55-1-W.
**305** *Wedgeplug Valve Co.

**Valves, Porcelain**.....Company makes available detailed literature covering the features and advantages of porcelain valves. Bulletin includes complete description, characteristics and specifications of product line.
**303** *Lapp Insulator Co.

**Valves, Stainless Steel**.....Offers technical data on stainless steel valves—a 12 p. booklet covering stainless steel valve design, selection, maintenance and repair. Request Product Bulletin VTD.
**287a** *Cooper Alloy Corp.

## Process Equipment

**Absorbers**.....For absorption of hydrogen chloride and other gases. Produce as much as 20 tons per day 22° Baume acid. Pneumatic automatic control. Complete information in Catalog Section No. S-7460.
**235f** *National Carbon Co.

**Centrifugals**.....Illustrated, 16 p. describes operation & features of: "Ter Meer" continuous centrifugal (Type S); "Ter Meer" universal filtering centrifugal (Type HS); etc. Request Catalog No. C-55.
**456A** Baker Perkins.

*From advertisement, this issue

**Centrifugals**.....When your process calls for liquid-solids separation by centrifugal force . . . you can do it more economically with the new Tolhurst Center-Slug centrifugal. Request descriptive Catalog.
**219** *American Mach. & Metals.

**Centrifuges**.....12p. describes numerous features & advantages of product line: peeler centrifuges HZ; pusher centrifuges SZ; screenworm centrifuges KMZ; decanting centrifuges KVZ; etc. Bulletin S-225e.
**380a** Krauss-Maffei-Imperial.

**Demineralizers**.....Available in two-bed, three-bed, four-bed and mixed bed units, of manual and automatic designs, and for any capacity. For complete information, request company's Bulletin No. 5300-B.
**388** *Cochrane Corp.

**Demineralizers, Water Treatment**..... Standardized Illco-Way "Package-Unit" De-Ionizers are completely put together at the factory. Details of compact, efficient, time-proved units in Bulletin PK-154.
**L461** *Illinois Water Treatment Co.

**Dryers**.....For solids drying . . . mechanical McNally Dryclone separates at low cost. Here is high drying efficiency, with drying costs held to a few cents per ton. Request descriptive drying Bulletins.
**446** *McNally Pittsburgh Mfg. Corp.

**Dryers**.....Help solve problems of drying air or other gases. Offer valuable advantages: simplicity of operation & maintenance; low installation cost & minimum maintenance expense. Details in Bulletin D-29.
**75** *C. M. Kemp Mfg. Co.

**Dryers**.....Ruggles-Coles indirect-fired dryers and heaters: dry without contamination from combustion gases, regardless of fuel; collect vapors at high concentration; etc. Data in Bulletin No. AH-438-11.
**378** *Hardinge Co.

**Dryers**.....Lectro-dryers can dry air & gases in volume to dewpoints below —100°F—can drop relative humidity lower than 10%. Booklet describes machines & how various industries use them to gain efficiency.
**88** *Pittsburgh Lectrodryer Corp.

**Dryers, Rotary**.....Deliver top production, exacting performance, greater profits. Tells how Standard-Hersey has aided manufacturers throughout the world in solving their dryer problems in illustrated, 12 p.
**TL375** *Standard Steel Corp.

**Dryers, Rotary**.....The Davenport rotary hot air dryer is of stainless steel construction. Dryer is installed in one of the large processing plants, drying wheat gluten. For complete details, request Catalog A.
**TL373a** *Davenport Mach. & Foundry.

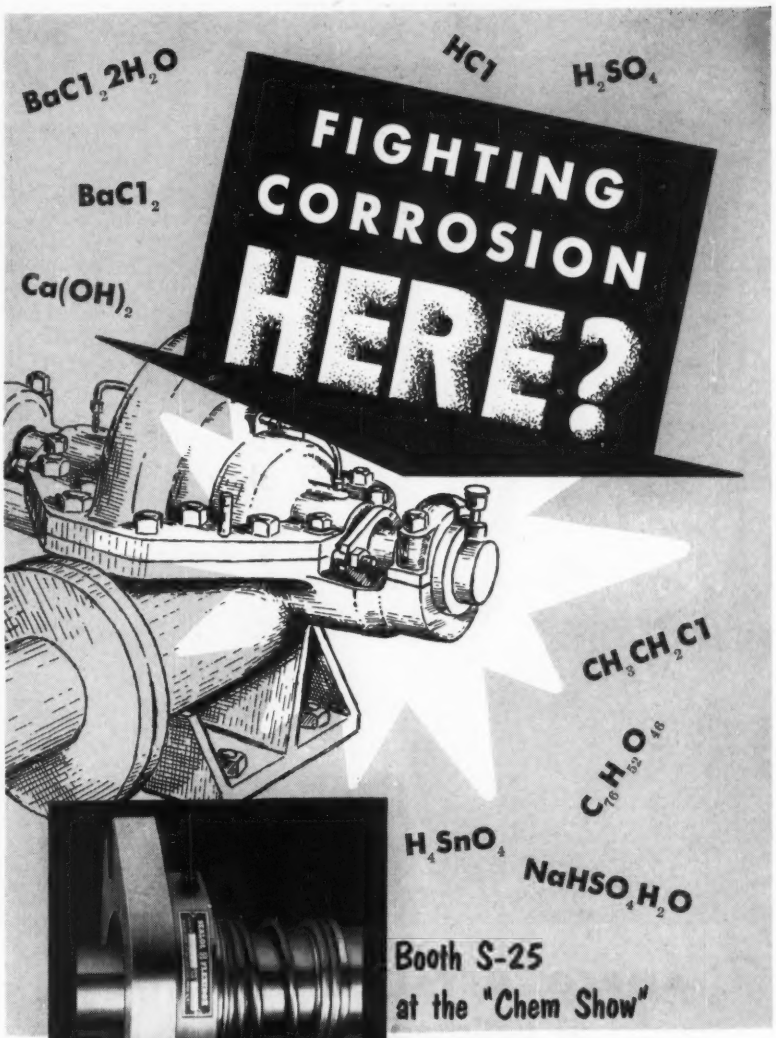
**Drying Equipment**.....To improve your product call on Proctor & Schwartz who not only manufacture drying equipment, but have the know-how to help you in materials handling problems. Request Bulletin 390.
**456a** *Proctor & Schwartz.

**Dust Collectors**.....In almost every type of industry . . . users have found high efficiency, simplicity & economy of Dustube collectors a difficult combination to equal for top performance. Bulletin No. 372C.
**302** *American Wheelabrator.

**Dust Collectors**.....Model D Aeroturn dust collector offers high-efficiency filtering & reverse-air-jet filter cleaning in a factory assembled & tested unit. Capacities from 500 to 7200 cfm. Bulletin No. 3.
**B428** *Turner & Haws Engrg. Co.

**Dust Control**.....Pangborn engineers help solve your dust problems—line of wet or dry dust collectors can save time, trouble & money. See how varied industries are benefited in "Out of the Realm of Dust."
**355** *Pangborn Corp.

*From advertisement, this issue


Why struggle with Stuffing-box failures when Sealol-Flexibox Mechanical Shaft Seals are eliminating corrosion problems in centrifugal pumps handling equipment-killers like these:

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| Acids and Hydrocarbons | at 220 psi —225°F |
| 8% Sulfuric Acid | at 40 psi —150°F |
| Acetic Acid | at 146 psi —128°F |
| Sugar Liquors | at 15 psi —210°F |
| Black Liquor | at 15 psi —180°F |

Tell us about your centrifugal pump sealing problems . . . our engineers will specify the exact combination of Sealol-Flexibox corrosion-resistant materials, such as Hastelloys, Monels, Stainless Steels, Ceramics, and Teflon®, to suit your equipment and process. And write today for Bulletin 10 containing complete information about Sealol-Flexibox Mechanical Shaft Seals. ®DuPont Trademark

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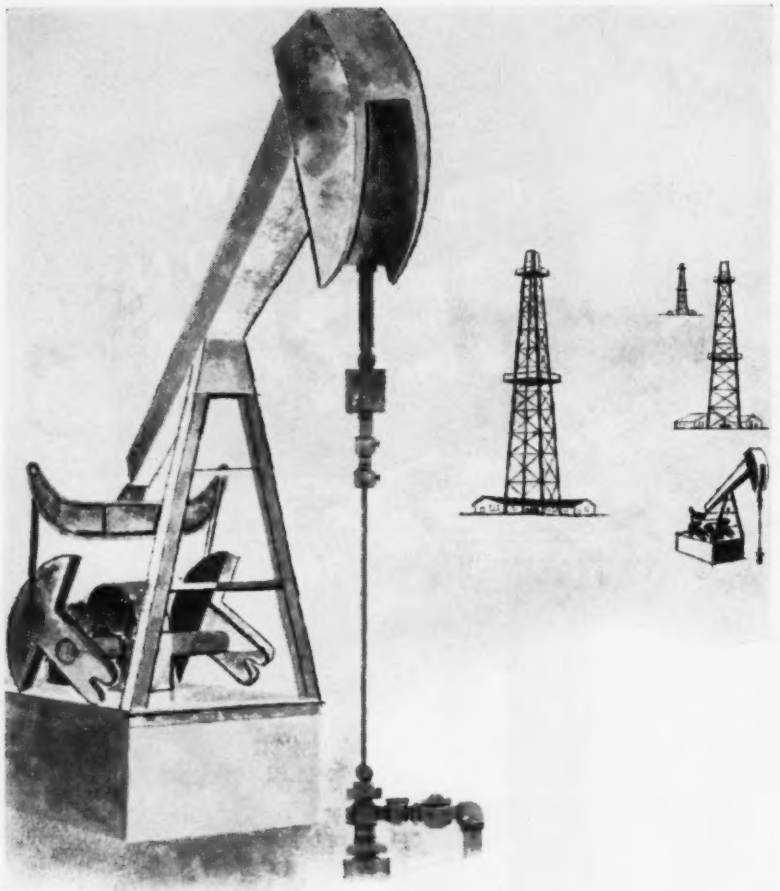
THE BALANCED PRESSURE SEAL



## AMPCO* METAL quadruples life of polished rod liners

*Critical part sets new records in tough oil-well service, thanks to Ampco Metal's remarkable corrosion- and sliding-wear resistance*

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With ordinary bronzes, Cities Service Oil Company found frequent replacement to be a constant headache. Then, in certain areas, it switched to liners made from Ampco Metal Pipe. Cities Service engineers report a substantial reduction in liner replacements.

Ampco Metal Liners last four times as long as plain bronze liners because they are made from a unique aluminum bronze alloy. It's a remarkable bearing material—has unusual resistance to mechanical wear. It withstands the corrosive effects of many acids and caustics. And when used as pipe it combats erosion from solids held in suspension.

Ampco pipe and tubing is available in all sizes, along with a complete line of flanges and fittings. Write today for full information.

*Reg. U. S. Pat. Off.

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Dept. CE-12
*Sole Producer of Genuine Ampco Metal*

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Milwaukee 46, Wisconsin
West Coast Plant
Burbank, California

PR-20


## LITERATURE . . .

**Evaporation & Spray Drying**.....Swenson can help you solve evaporation & spray drying problems. You benefit through experience gained in over 66 years of practical application. Catalog tells the full story.
7 *Swenson Evaporator Co.

**Evaporators, Turba-Film**.....Evaporators give rapid one-pass evaporation of liquids, slurries and gases . . . especially heat-sensitive substances . . . all by continuous process. Literature available on request.
173 *Rodney Hunt Mach. Co.

**Filters**.....Makes available descriptive booklet covering the Sel-Rex Double Duty Filters . . . for use in electroplating, chemical processing, pharmaceuticals, food and beverages, paints and varnishes, etc.
458A Bart-Messing Corp.

**Filters**.....Fully illustrated, 8 p. covers rotary suction cell filters, pulp filters, bleaching plants, filter washing plant, cylinder wet machines, and Imperial Dryers for the chemical and process industries.
380b Krauss-Maffei-Imperial.

**Filters, Liquid**.....12 p. offers specifications, engineering & performance data, photos & descriptions of recommended types of filter media, check list of liquids that can be filtered, etc. Bulletin D-1L.
299 *Dollinger Corp.

**Filters, Pressure Leaf**.....For flow rates two to five times greater than cloth covered presses; positive removal of all suspended solids to desired degree of clarity; etc. Find details in Catalog No. NC-1-53.
217 *Niagara Filters Div.

**Filters, Tubular**.....Describes new tubular filters by Industrial . . . with important new features due to flow from inside of tube. Covers features and operation in complete detail. Bulletin TS-160-755.
449 *Industrial Filter & Pump Mfg.

**Flakers**.....Stokes flaker replaces batch method in the processing of moth-killing chemical. Full details of laboratory and advisory service for solution of production problems are covered in Bulletin No. 640.
304 *F. J. Stokes Mach. Co.

**Mills, Ball & Pebble**.....Outstanding in the field of fine grinding, mixing and processing. Built of all steel welded construction, they feature great strength and ruggedness. 20 p. illustrated Catalog No. 100.
275f *International Engrg.

**Mills, Roller**.....Positive and continuous precision size control at exceptionally high production rates are but two of the numerous features of Williams Roller Mills. Request fully descriptive literature.
101 *Williams Patent Crusher.

**Mills, Roller**.....When making any kind of powdered pigments or commercial fillers, use of High-Side Roller Mill with Whizzer Separation offers important production advantages. See Catalog No. 79.
340 *Combustion Engrg.

**Mixers**.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.
215d *Mixing Equipment Co.

**Mixers**.....Builds a complete line of mixing & kneading equipment for the chemical process industries including the new revolutionary B-P List System of Continuous Mixing. Data in illustrated Catalog CE-55.
458B Baker Perkins.

**Mixers**.....Data on turbine & slow speed heavy duty agitators . . . for open & closed tanks. Covers operation & applications of super-turbine & injection mixers, mixer data, mixer drive heads, etc. Bulletin No. 76.
275b *International Engrg.

*From advertisement, this issue

**Mixers**.....Describes the Day Imperial Mixer. Built for heavy duty, engineered for precision, it incorporates many advanced engineering features to assure you high production at low cost. Bulletin No. 600.
357 *J. H. Day Co.

**Mixers**.....Eastern's mixers are designed to meet the needs of today's chemical and industrial processes. Covers portable mixers, top and side entering mixers, turbine mixers, etc. in Catalog Series No. 26.
165a *Eastern Industries.

**Mixers**.....Mix-Mullers for chemical and process industries. Covers Simpson mulling principle; mulling for dry, wetted and plastic mixtures; Mix-Mullers for special requirements; etc. 12 p. Bulletin No. 522.
153 *National Engrg. Co.

**Mixers**.....The Eppenbach Homo-Mixer is a high speed, high shear homogenizer-mixer. Literature covers description, method of operation, numerous advantages, etc. Request illustrated Bulletin No. 402-R-1.
T435 *Admiral Tool & Mfg. Co.

**Mixers, Dry**.....Describes conical blenders (design, operation, application, capacity, sizes & specifications) & ribbon mixers (operating & construction features, specifications, etc.). Illustrated Bulletin No. 78.
275d *International Engrg.

**Mixers, Paste**.....“Pony” paste mixer combines mixing advantages of sigma blade, or heavy duty, paste mixer with versatility & ease of cleaning of a change can mixer. Illustrated Folder offers full details.
444 *Herman Hockmeyer & Co.

**Mixers, Portable**.....Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. 28 p. No. B-103.
215e *Mixing Equipment Co.

**Mixers, Portable**.....Includes information on the numerous features and advantages, materials of construction, sizes and specifications, portable-permanent mountings, etc., in illustrated Bulletin No.74-A.
275e *International Engrg.

**Mixers, Side Entering**.....The Type “NU” side entrance mixer is a brand new unique mixer design. It has no cast parts and is of all welded construction, including the stuffing box. Illustrated Bulletin No. 72-A.
275e *International Engrg.

**Mixers, Steam-Water**.....No. 1350 Series injects steam directly into the water, using every BTU of heat energy to bring water to a constant, predetermined temperature. Descriptive literature upon request.
162-3h *Fulton Sylphon Div.

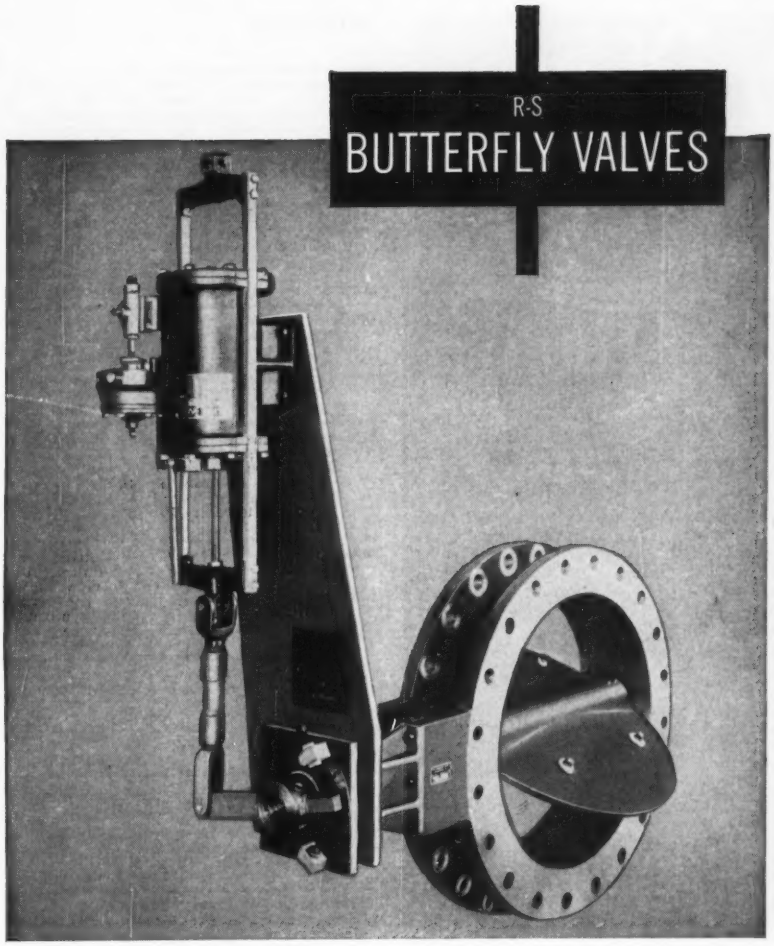
**Mixers, Top Entering**.....Illustrated and detailed 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. Catalog No. B-102.
215a *Mixing Equipment Co.

**Mixers, Top Entering**.....Information on top entering propeller mixers. Includes data on selection, construction features, sizes & specifications of high & slow speed top entrance mixers, etc. Bulletin No. 73.
275a *International Engrg.

**Mixers, Top Entering**.....Makes available pertinent information on top-entering mixers (propeller type) . . . for closed tanks, pressure & vacuum . . . for open & loose-covered tanks. Data in Catalog No. B-103.
215b *Mixing Equipment Co.

**Mixers, Water, Hot-Cold**.....Descriptive literature on new hot-cold water mixers. No. 1350 Series Mixers give an accurate, controlled source of tempered water. Unaffected by variations in water pressure.
162-3g *Fulton Sylphon Div.

*From advertisement, this issue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These design features have won complete process control acceptance for R-S Butterfly Valves. In your processing system, an R-S Valve will give you every advantage in . . .

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# FROM RAINCAP TO HOOD

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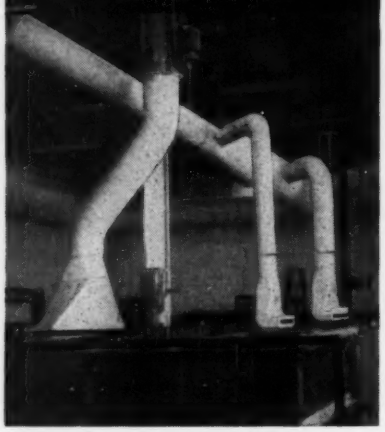

Illustrated above is part of a new PLA-TANK Duct System which is typical of dozens being installed for fume exhausts in plating rooms, maintenance shops and chemical processing plants. PLA-TANK was chosen for the entire system from hoods to raincaps on the outside stacks.

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## LITERATURE . . .

**Presses, Filter**.....Offer numerous features: lowest cost per sq. ft. of filtering area; produce perfect clarity of filtrate; can be used in decolorizing—deodorizing; etc. Request illustrated Catalog No. 55.
**BL379a** *T. Shriver & Co.

**Processing Equipment**.....Describes corrosion-resistant processing equipment . . . precision built to your specific requirements to give long years of peak performance with low maintenance. Technical Bulletins.
**350** *Lee Metal Products Co.

**Pulverizers**.....Valuable data on Superfine pulverizer . . . a centrifugal air attrition impact pulverizer and classifier in a single unit. Covers numerous features, specifications, construction, etc. Illustrated.
**TR432** *Schutz-O'Neill Co.

**Reactors, Glassed Steel**.....Six different agitator speeds: 60, 90, 120, 175, 250 & 340 rpm are now available on Pfaudler reactors up to 100 gallons. For complete product information, request Bulletin No. 923.
**476a** *Pfaudler Co.

**Reclamation Systems**.....Denver reclamation systems take dollars out of your wastes—if you have valuable materials in your wastes, these systems can make recovery profitable. Request illustrated literature.
**269** *Denver Equipment Co.

**Screens, Vibrating**.....For high-capacity screening of a broad range of materials—"CA" vibrating screens are your answer. In complete range of sizes to suit all plant capacity requirements. New Book 2554.
**42a** *Link-Belt Co.

**Screens, Vibrating**.....For economical separation of light to medium weight materials—choose "UP" vibrating screens. In open, semi-enclosed, or totally-enclosed types. Complete details contained in Book 2377.
**42b** *Link-Belt Co.

**Separating & Sizing Machinery**.....If you process granular materials that must be uniform in length, widths, or thickness, Hart-Carter sizing machinery may be what you need. Details in Folders CPG-2 and L-1.
**R375** *Hart-Carter Co.

**Strainers**.....Feature positive and 100% continuous fluid cleaning. Cuno Auto-Klean Strainer is the only fluid cleaner on the market that works uninterruptedly. Request copy of Auto-Klean Bulletin.
**301** *Cuno Engrg. Corp.

**Wire Cloth**.....84 p. catalog describes company's facilities for fabricating wire cloth parts. Includes wire cloth parts for screening, filtering and special uses. Also provides helpful metallurgical information.
**364** *Cambridge Wire Cloth Co.

## Pumps, Blowers, Compressors

**Blowers**.....Describes Spencer Turbo-Blowers in sizes up to 250 hp for step aeration, activated sludge, chamber aeration, air blow-back, washing grit, air flotation of solids & greases, etc. Bulletin 142-B.
**460A** Spencer Turbine Co.

**Compressors, Centrifugal**.....Offers a complete line of centrifugals for gas compression and refrigeration—up to 10,000 horsepower in a single unit. Details in booklet, "Centrifugal Compressors for Industry."
**168** *Carrier Corp.

**Compressors, Oil-Free**.....Offer space-saving design, excellent service, economical operation, etc. Company builds regular and oil-free compressors to meet any capacity and pressure need. Bulletin No. A-44.
**8** *Joy Mfg. Co.

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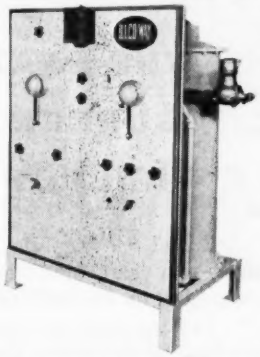

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**Fans**......"Buffalo" Type BL Limit-Load Ventilating Fan offers the finest features—for quite, stable, efficient performance in industrial service. Further details in Bulletin F-102, your copy on request.
**20** *Buffalo Forge Co.

**Fans & Boosters**.....Describes line of stack fans & duct boosters. Includes information regarding advantages, applications, details of construction, dimensions, capacities, etc. in 16 p. illustrated Bulletin No. 109-A.
**275g** *International Engrg.

**Pumps**.....Announces availability of a new Bulletin describing handling of corrosives at Litho Chem. & Supply Co. Covers use of pump for a variety of solutions including hydrochloric, formic and lactic acids.
**461A** Vanton Pump & Equipment.

**Pumps**.....Practical Guide to Pump Selection—illustrations & descriptions with capacities & adaptability of pumps contained in compilation of facts to help avoid costly misapplication. Bulletin No. S-146.
**R461** *Taber Pump Co.

**Pumps**.....Describes the Flow-Master pump . . . an exceptionally efficient, precision built stainless metal rotary pressure pump for transferring and metering. Features and engineering data. Catalog No. 25C.
**461B** Marco Co.

**Pumps**.....Makes available a new edition of the "Handbook of Hydraulic Tables and Other Engineering Data," 28 p. reference work for hydraulic engineers interested in pumping & piping problems. Bulletin 50.
**461C** Aldrich Pump Co.

**Pumps, Acid**.....Mighty midget for pumping acids. Jabsco neoprene-impeller pump made of Ace hard rubber outlasts, out-pumps anything in its pressure, size and price class. Full details in Bulletin No. 97.
**344d** *American Hard Rubber Co.

**Pumps, Centrifugal**.....From impeller to shaft seal . . . Weinman pumps are built better. The built-in quality adds up to cost-saving, pumping efficiency for every job. Request descriptive product Bulletins.
**349** *Weinman Pump Mfg. Co.

**Pumps, Centrifugal**.....Impervious graphite pumps feature mechanical seal with enclosed coolant, rugged type SN armored connections, interchangeable parts, wide capacity range, etc. Catalog Section S-7250.
**235a** *National Carbon Co.

**Pumps, Centrifugal**.....Original manufacturer of self-priming centrifugal pump offers data on new Type CG LaBour—operates under positive or negative suction lift conditions as required. Request Bulletin G-1.
**253** *LaBour Co.

**Pumps, Centrifugal Chemical**.....Worthington offers you the widest standard corrosion-resistant pump line as Karbate impervious graphite supplements Worthite. Request Bulletins W-350-B14A and W-350-B18.
**309** *Worthington Corp.

**Pumps, Centrifugal Chemical**.....New—self-priming Worthite centrifugal chemical pump features wider coverage in capacity and head than any similar pump in the chemical industry. Bulletin No. W-350-B-13.
**270-1** *Worthington Corp.

**Pumps, Centrifugal Stock**.....Selected sizes of B&G Series 1522 & 1531 centrifugal pumps are stocked at factory for immediate shipment. Capacities to 225 gpm, heads to 140 ft. Price & Selection Catalog.
**61** *Bell & Gossett Co.

**Pumps, Centrifugal Sump**.....Principal use for vertical centrifugal sump pumps is for pumping waste water or sewage where outlets are located below sewer level. Data in fully illustrated Bulletin No. WQ-220.
**461D** Warren Steam Pump Co.

*From advertisement, this issue

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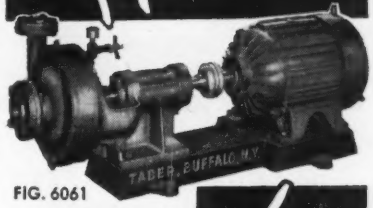
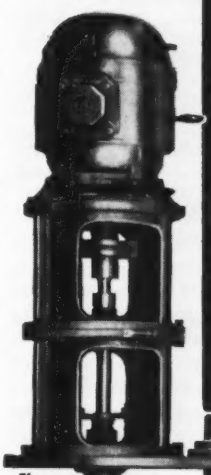



FIG. 6061



for DECIDING ON TYPE OF PUMP; Write for TABER BULLETIN S-146

Fig. 19,488

Practical GUIDE TO PUMP SELECTION

Big illustrations and brief descriptions with capacities and adaptability of pumps are contained in this unbiased compilation of facts to help avoid costly mis-application. Bulletin S-146.

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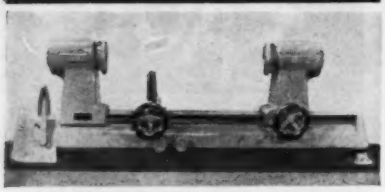

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| Maximum width overall | 18½" |
| Maximum length spindle nose to spindle nose | 36½" |
| Height | 20½" |
| Radial clearance above apron | 9" |
| Spindle hole diameter | 2⅝" |
| Approximate shipping weight | 550 pounds |
| Net weight | Approx. 400 pounds |

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Two face plates
One collet draw-in bar
One twelve-fire single jet adjustable oxygen-gas or oxygen-hydrogen burner
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## LITERATURE . . .

**Pumps, Chemical**.....Offer new features that make them rugged, dependable, long-lived pumps for handling corrosive liquids. In 9 sizes providing capacities up to 720 gpm & heads up to 200 ft. Bulletin 725.4.
**50** *Goulds Pumps.

**Pumps, Double Suction**.....Rugged double suction pumps assure long life and low maintenance. Feature heavy-duty construction, wide material choice, unit responsibility, etc. Offers details in Bulletin No. 08B6146.
**161** *Allis-Chalmers Mfg. Co.

**Pumps, Plastic**.....Announces new reference on Vanton Flex-i-liner Plastic Pumps. Includes complete operating & performance data along with materials of construction & application tables. Catalog No. 55.
**294** *Vanton Pump & Equipment

**Pumps, Propeller**.....Lawrence propeller or axial flow pumps are widely used to circulate large volumes of liquid or slurry against low heads as in evaporators, crystallizers, etc. Details in Bulletin 203-6.
**453** Lawrence Pumps.

**Pumps, Rotary Screw**.....Catalog LS gives useful applications & specification data on IMO pumps & article, "Rotary Pumps, Basic Considerations in Their Application," describes rotary pumps in general.
**312** *De Laval Steam Turbine Co.

**Pumps, Rubber-Lined**.....Company's line of Type DS Rubber-Lined Pumps provide valuable features: longer pump life; maintenance savings; elimination of shutdowns. For details, request Bulletin 932.
**358** *Buffalo Forge Co.

**Pumps, Sealless**.....Combining motor & pump in a single unit, Chempump is most significant advance in pump design in half a century. Hard-to-handle fluids can't leak or become contaminated. 16 p. Bulletin 1010.
**224-5** *Chempump Corp.

**Pumps, Sump**.....Handle corrosive liquids for years without trouble. Available in sizes from 1 to 10-inch discharge with capacities ranging up to 3,000 gpm and heads up to 140 feet. Data in illustrated Bulletin 4600-A.
**376** *Deming Co.

**Pumps, Vacuum**.....Tells how & why company developed new line of diffusion & booster pumps to fill need for faster pumping in pressure range where most high vacuum processing is now being done. Bulletin No. 756.
**462A** F. J. Stokes Mach. Co.

**Pumps, Vacuum**.....Important operating factors, which add up to R-C "plur-ability", account for rapidly increasing use of positive displacement vacuum pumps for industrial processing. Bulletin 50-B-13.
**455** *Roots-Connversville Blower.

**Pumps, Vacuum**.....NRC rotary gas ballast pumps keep their original high efficiency even when pumping troublesome vapors. Includes complete engineering information in company's profusely illustrated Bulletin.
**407** *Naresco Equipment Corp.

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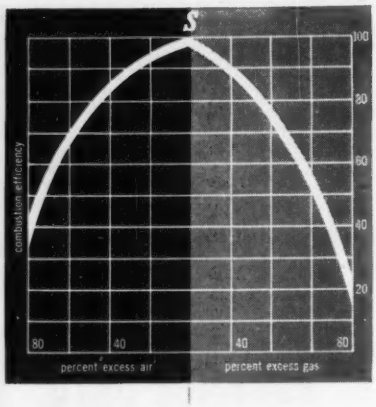


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**Ventilators**.....The Bifurcator Roof Ventilator shields its fan motor from the destructive rush of hot or corrosive fumes. Designed for easy roof curb mounting. For details, request Bulletin No. DB-37-55.
**221** *DeBothezat Fans Div.

## Services, Processes, Misc.

**Annealing Facilities**.....Weldco continuously anneals 3" to 12¾" stainless steel tubing through a conveyor-type gas-fired furnace with a water spray quench. Request complete data and literature.
**290d** *Youngstown Welding & Engrg.

**Burn Kits**.....Newly published reference describes the M-S-A Foille Burn Kit . . . for immediate treatment of all types of burns. Points out advantages of aerosol spray technique. Request Bulletin No. 0402-3.
**463A** Mine Safety Appliances Co.

**By-Product Recovery**.....Blaw-Knox is prepared to help you solve any by-product or industrial waste recovery problem you man have. A valuable reference on By-Product Recovery is available. Catalog 351.
**154** *Blaw-Knox Co.

**Engineering Services**.....Help protect your equipment investment—application engineering, analytical engineering, product development, field-service engineering, maintenance service, etc. Brochure GED-2244.
**93-6b** *General Elec. Co.

**Fire Extinguishers**.....Efficient, dependable & superior in design, new expanded line of Kidde extinguishers now make it easier for you to choose the right extinguisher for every fire hazard. P-8 Catalog.
**342** *Walter Kidde & Co.

**Laboratory Equipment**.....136 p. book contains a careful and diversified selection of the newest and most efficient equipment for laboratories of all types. Includes specifications and price data. Catalog Sup. A-6.
**463B** Will Corp

**Numbers & Letters**.....Company announces the development of individual, self-sticking Numbers and Letters, in six sizes from ¼" to 5" high, mounted on handy dispenser cards. Request 6 p. Bulletin No. 165.
**463C** W. H. Brady Co.

**Plants, Pilot**.....Data sheet covers new 15-gal. reaction-distillation pilot plant. Complete & Compact, packaged test unit is designed for general experimentation in resin manufacturing & similar processes.
**463D** Paterson-Kelley Co

**Reproduction Materials**.....Kodagraph reproduction materials for new techniques . . . new savings . . . new standards of quality—in drawing and document reproduction. Full details in illustrated, 20 p.
**293** *Eastman Kodak Co.

**Safety Equipment**.....Specification Sheet describes film badges for personnel protection. Badges indicate amount of radiation which laboratory & other workers are receiving from x-rays or radioactive isotopes.
**463E** Nuclear Instrument & Chem

**Screen Processing on Plastics**.....
"Screen Process Printing on Plastics" is the subject of a new Technical Service Bulletin. Describes equipment, procedures, and paints used in screening on plastics. 5 p.
**463F** Lozo, Inc.

**Tools, Maintenance**.....Gardner-Denver maintenance tools make plant housekeeping easier. Descriptive bulletin covers trench diggers, paving breakers, clay spaders, air hoists, sheeting drivers, drills, etc.
**68a** *Gardner-Denver Co.

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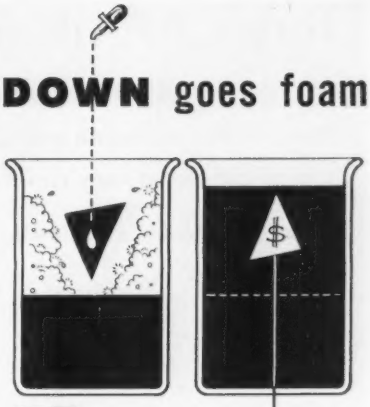


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[1] Permissible in food processing at concentrations up to 10 ppm.
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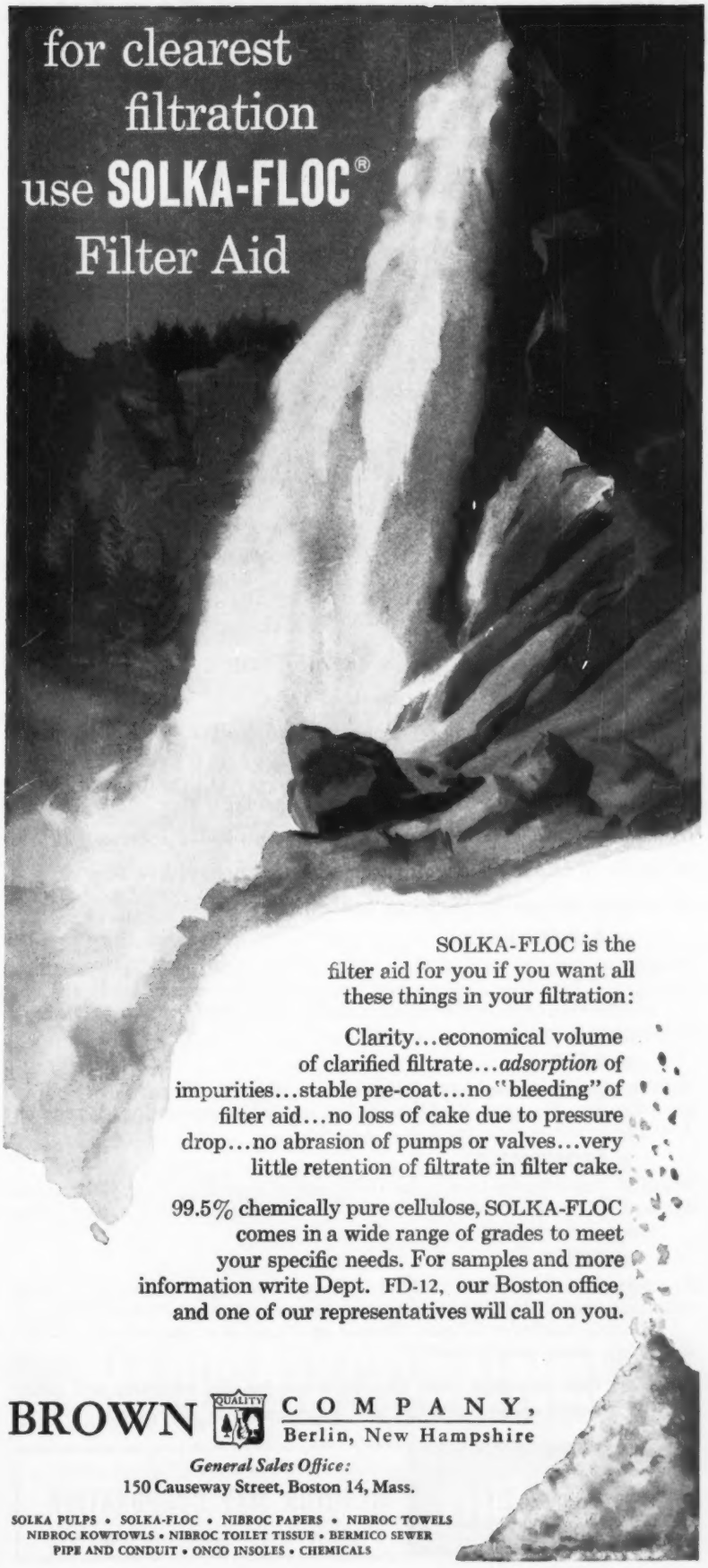


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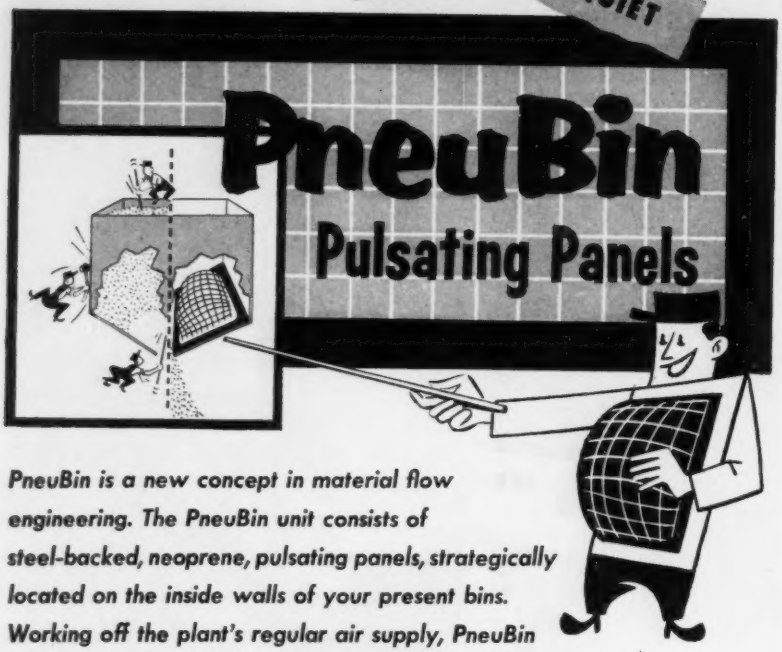


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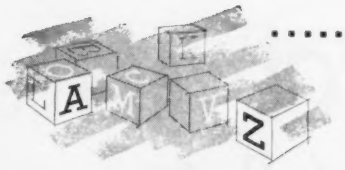


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FIG. 2698

FIG. 444

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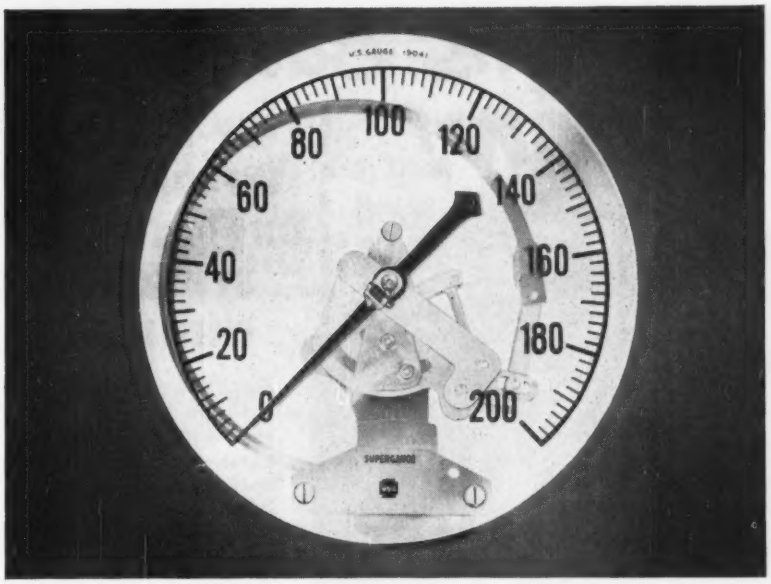


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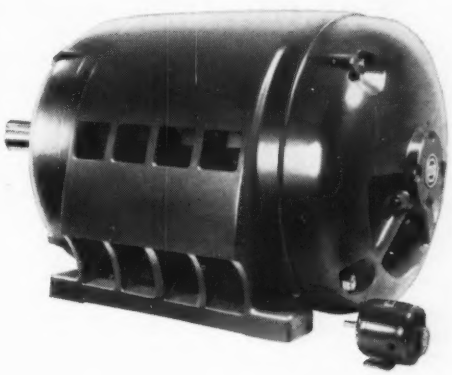

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# Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.

# New glassed steel designs offer you better yields, lower costs, less corrosion

## No contamination, no leakage with new seal for reactors

No metallic contamination of your product. No stray, unwanted catalysts. No escaping vapors.

These are the advantages of a new nonmetallic rotary Crane-type seal now available on Pfaudler glassed or stainless steel reactors up to 100 gallons. (A similar design is also available for larger units.)

Only Pfaudler glass, Teflon, ceramic and carbon come into contact with your product. Design of the seal is simple, easily maintained.

## New development boosts corrosion resistance of columns

Better results from fractionation and other processes requiring a column are now possible with the added corrosion resistance of a new Pfaudler development.

It's a glassed steel distributor plate, available for all size columns. Using Pfaudler acid-alkali-resistant glass, this plate provides complete flexibility of use over a range up to pH 12 at 212° F.

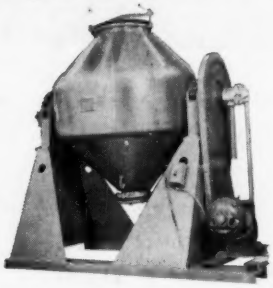
The corrosion resistance of this glass protects product purity, simplifies cleaning, and protects your equipment investment.

## Dryer-blender tumbles out 4 days' work in 7 hours

In actual use, a Pfaudler glassed steel conical dryer-blender is producing as much dried product in 7 hours as formerly required at least 4 working days, using a different type of dryer.

Double-cone shape, tumbling action and efficient heating design are responsible for this great speed. In addition, a broad range of corrosive applications is possible, because the unit is fabricated of Pfaudler's special acid-alkali-resistant glassed steel.

To pre-test your product in the



Pfaudler dryer-blender, a small 2'-diameter test model is available. Write or phone your Pfaudler representative for full details.

## New Pfaudler hydraulic drive and seal

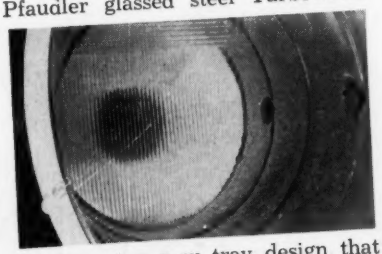
The new Pfaudler hydraulic drive and seal offers many advantages: It can be made in both stainless steel and glassed steel construction for a large range of reactor sizes and for greater horsepower requirements with either hydraulic or air motors.

Any noncorrosive fluid can be used as a seal – even one of the ingredients of your own product – providing you 100% protection against contamination.

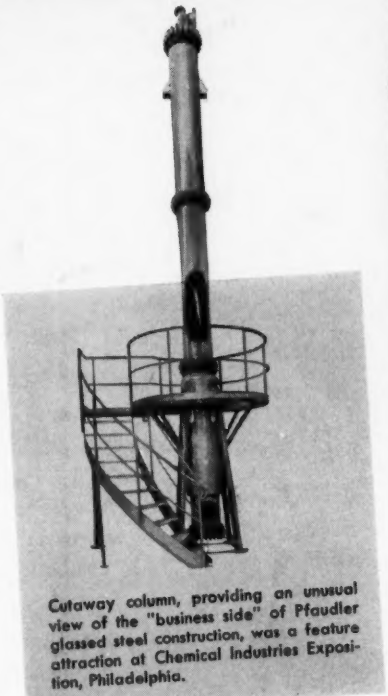
This seal is operated under pressure, requires a minimum of maintenance, and is designed to give years of trouble-free service. Your Pfaudler representative can provide full details at your request.

## New turbo-grid tray gives higher yield at lower cost

You're looking down the throat of a Pfaudler glassed steel Turbo-Grid



column, at a new tray design that provides enormously high capacities, yet lowers the cost of the column itself.



Cutaway column, providing an unusual view of the "business side" of Pfaudler glassed steel construction, was a feature attraction at Chemical Industries Exposition, Philadelphia.

The tray is constructed of high-strength PYREX brand glass tubes, with all their inherent advantages of corrosion resistance, physical toughness, and thermal shock resistance.

Because of the high capacity resulting from this design, the column itself can be of smaller diameter than previously required – an important means of cutting its cost.

## Now—variable agitator speeds ranging from 60 to 340 RPM

Six different agitator speeds: 60, 90, 120, 175, 250, and 340 RPM are now available on Pfaudler reactors up to 100 gallons.

These are made possible by interchangeable constant-speed sheaves of the new PW drive. As an alternative, variable pitch sheaves may be supplied, giving quick adjustment for *all* speeds ranging from 60 to 300 RPM.

The new PW drive rides high above the top head of the reactor, out of the way so you can have easy access to other nozzles.

Write for Bulletin 923.

**Pfaudler**

**THE PFAUDLER CO., ROCHESTER 3, N. Y.**